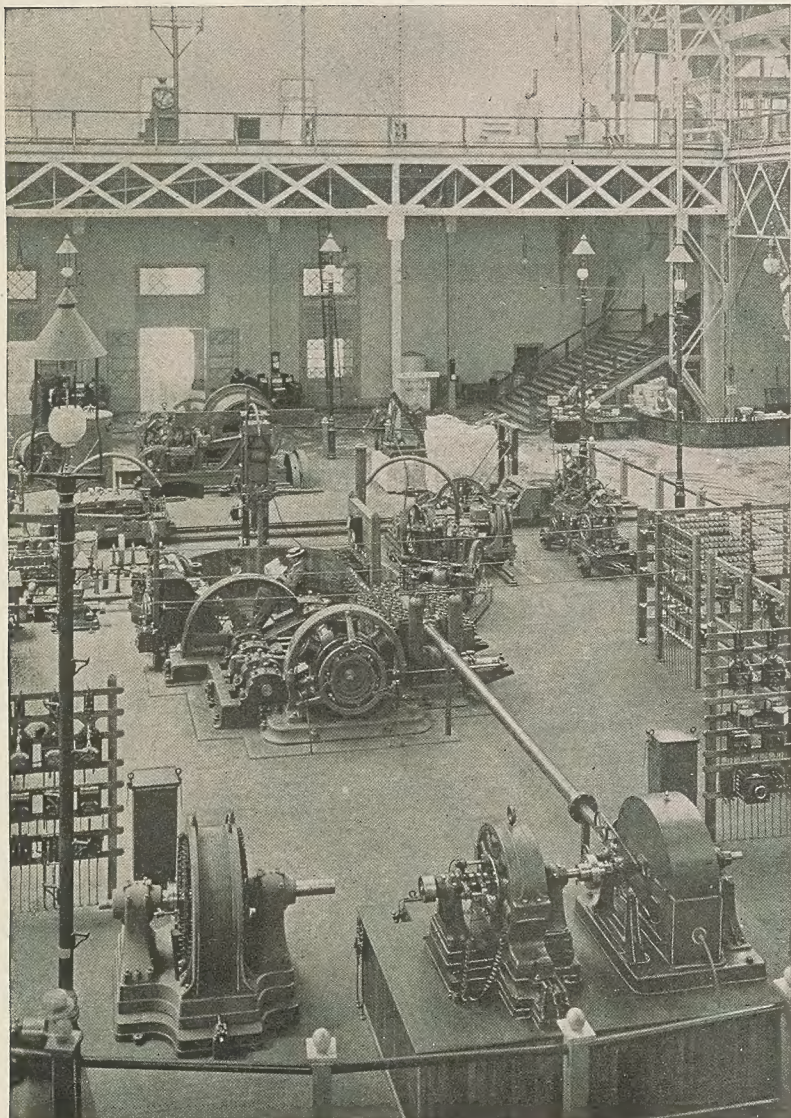


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Beaumont, Hubert Howe



VIEW IN ELECTRICITY HALL

"An effective piece of lighting appears in the Fisheries building. The large circular pavilion upon the east is used as an aquarium. Around the building are arranged continuous concentric rows of great tanks. The sides of these tanks are of clear glass, and are continued in the ceiling by stained glass screens, so that the observer walks in a covered corridor the sides of which are of glass, and through which can be seen the representatives of all the finny tribes disporting themselves in their native element. No lights are visible; but the tanks are lighted by hundreds of incandescent lamps placed under screens above the tanks, so that the light does not strike the eye, but is diffused throughout the water, which is illumined as effectively as at noonday."

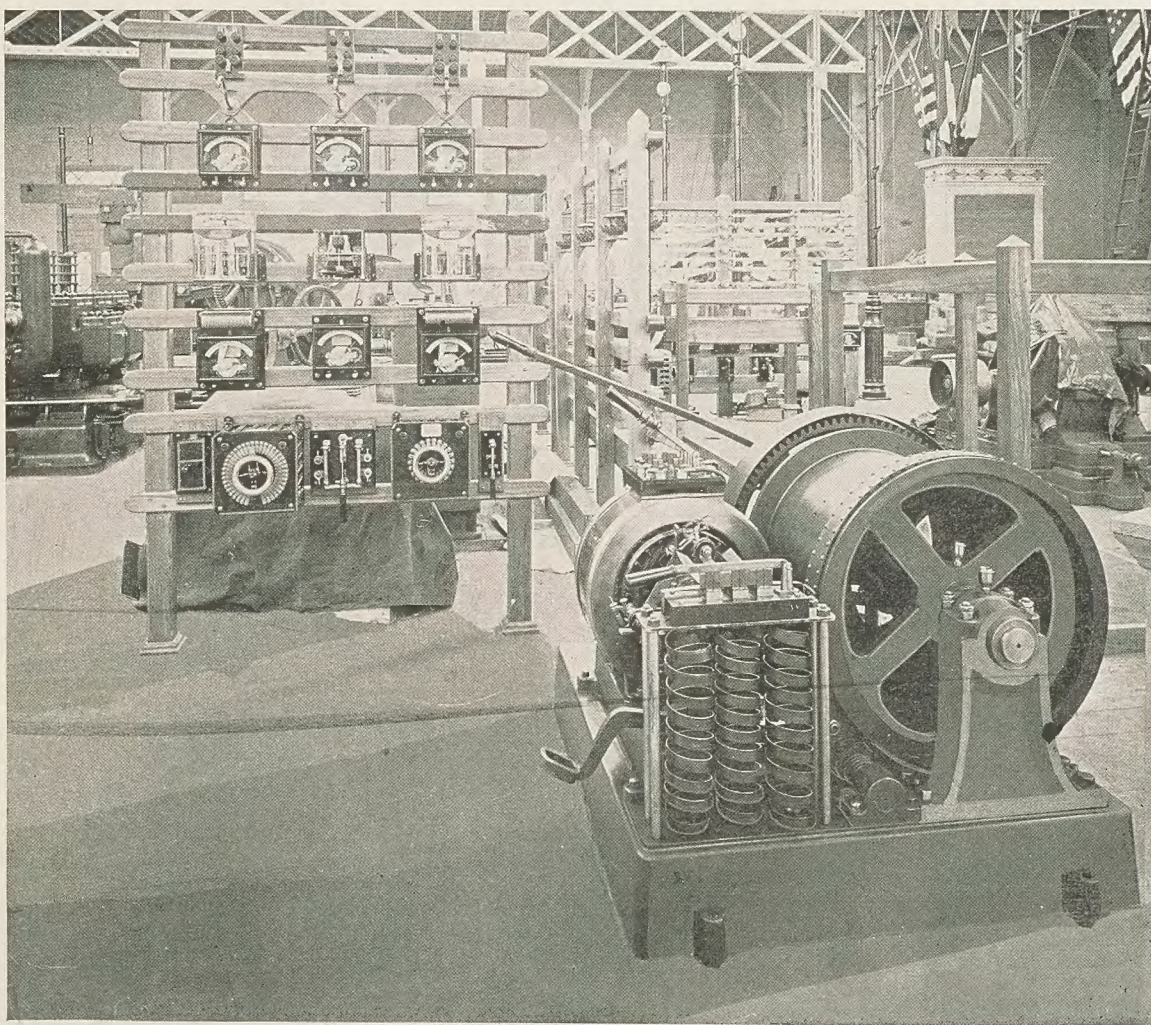
In the illuminated city of the Fair the attraction is not in the myriads of arc and incandescent lamps, with their elaborate settings, nor in the circular electroliers, some of them suspended, as in the hall of Manufactures, 150 feet above ground. Rather is it the part that each one plays in the general effect, the special feature that its light accentuates, all contributing to give to this wondrous display the aspect of a veritable fairyland, to raise it, for the moment, almost beyond the realm of matter.

Let us imagine ourselves standing at eventide in the central court, now almost a solitude, haunted by the shadows of deserted temples cast athwart the plaza. Toward the east darkness is settling over the waters of the lake. Northward and to the west a heavy pall of smoke broods over the great midcontinent metropolis, and far to the south the lurid flames of a blast furnace

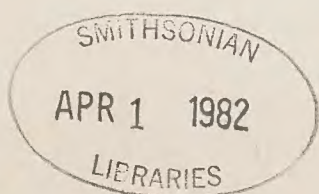
are faintly visible on the dusky horizon. Suddenly a beam of light shoots like a falling star from the lofty

dome of the Administration building, and a moment later its symmetrical outlines stand out in tracery of fire. At its base is a circling wheel of light, and a hundred torches further relieve the black abyss beyond. Meanwhile a thousand lamps, clustered around the central avenue, have turned the night into day. Thus also the other great buildings that encircle the court assume their robes of light, with pillars, porticos, and colonnades blending in weird, yet brilliant perspective, like the threshold of an enchanted palace.

From the summit of the Manufactures building a pyramid of dazzling light is cast on the dome of the Administration building, throwing into strong relief its delicate tracery of gold and white. Then in swiftly changing streams of white, green, and blue, purple,

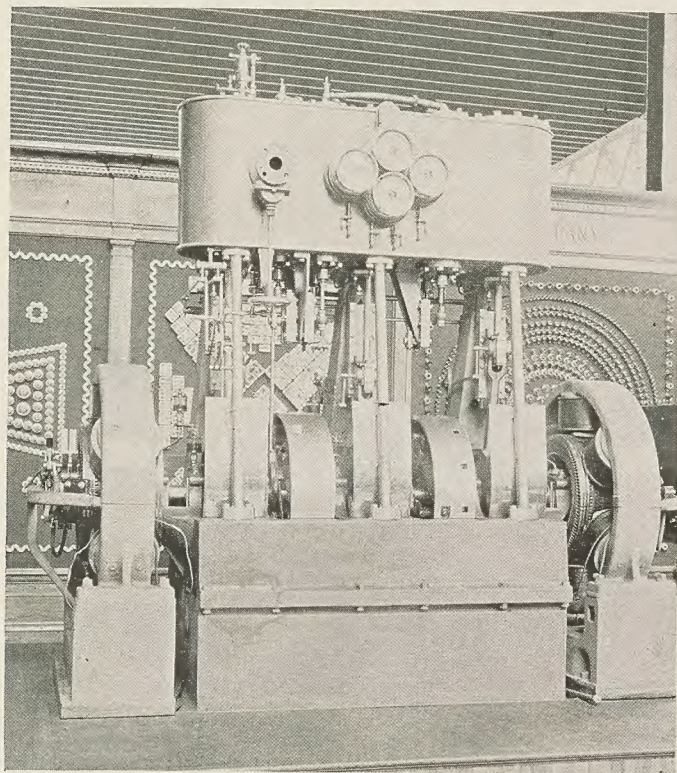


GROUP OF EDISON MACHINES



yellow and scarlet, three search-lights are turned simultaneously on the central court, the basin, the MacMonnies fountain, and the statuary here displayed in lavish profusion. In the heroic statue of the republic, with its background of double columns shining like pillars of Carrara marble, every inch of its golden surface glitters beneath the piercing rays. Presently the search-lights sweep the horizon, one of them resting for a moment on the graceful figure of Diana, poised against the sky as though suspended in mid air. Another is turned toward the lake, casting its bright sheen on the waters of Michigan, and striking the sails of a passing vessel, whose white wings slowly vanish from sight. Gradually the scene grows warmer in its wealth of coloring, and the lights and shades more intense in contrast, the copses and groves of wooded island, with its garb of verdure, throwing their shadows across the tracery of fire.

But the climax of all this brilliant display is in the electric fountains at the head of the lagoon in front of the Administration building. Here are light effects of surpassing loveliness, in rich varying hues, sprays, jets, and columns of water appearing as though ablaze in the glow of these powerful electric currents.



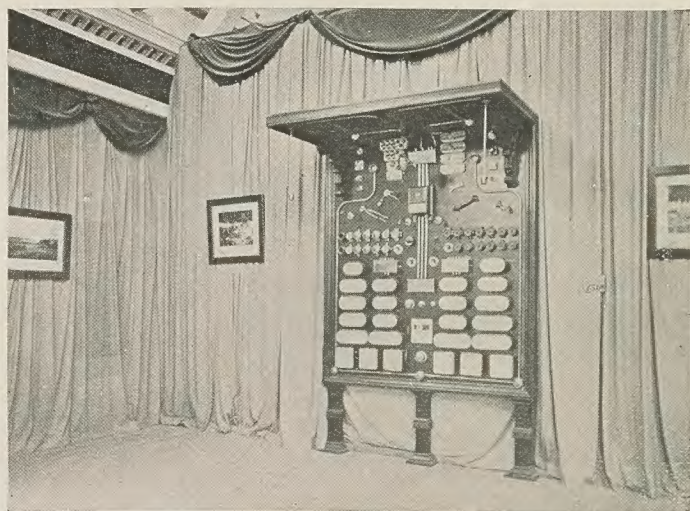
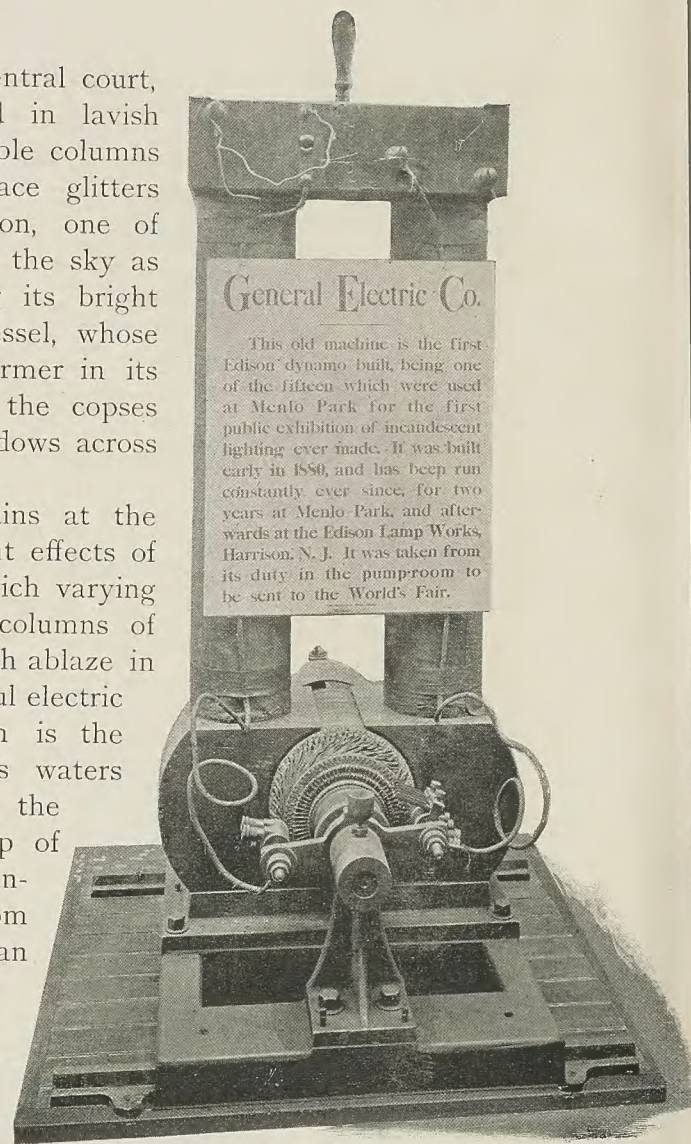
MULTIPLEX GENERATOR

Between them is the MacMonnies fountain, its waters iridescent as the rainbow, the centre-piece with its group of figures resembling a phantom ship with phantom crew, beautiful but with an unearthly beauty. Under these changing colors the vessel seems to float, now on a sea of white, and again on a rose-colored expanse, on frosted silver or on molten gold. Near by gondolas and electric launches speed swiftly to and fro across the lagoon, breaking its resplendent surface into a thousand glittering fragments, while from the plaza strains of music are wafted into the still night air, and above all is heard the ceaseless murmur of the waves, breaking on the shore adjacent, as with the low sad monotone of ocean.

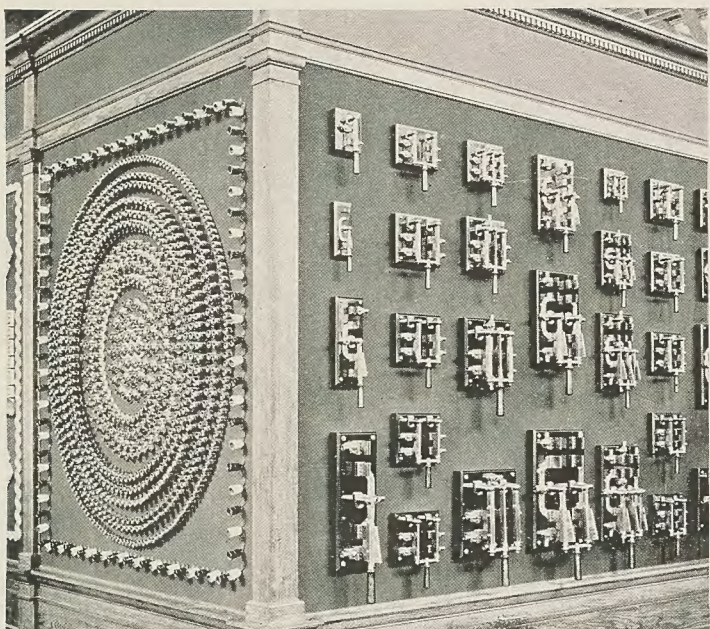
Such is the entertainment offered by night at the Fair, but on no two nights alike, presenting a new combination of brilliant effects at each illumination, and varied at times with fire-works, the latter, as it would appear, somewhat out of place amid this wonderful scenic display, and more than once threatening serious disaster to the Exposition buildings and their rich contents. No wonder that these artistic glories of the night, surpassing even the spectacular marvels of the day, brought visitors to the grounds by scores of thousands, and to the management a goodly increase of revenue. Under the glow of myriads of lamps the architectural symmetry of the design is displayed to excellent advantage, the uniform cornice level of the buildings, sixty feet above ground, standing clearly forth in tracery of incandescent lights, while encircling the basin near its water level an unbroken circle of vari-colored jets, each reflected from its glittering surface, gives to the scene a brilliance almost too dazzling for human eyes to rest upon.

From this brief description of the Fair by night let us turn to the exhibits proper of the department of Electricity, for here also are many attractions for every class of visitors. While some portions of the Exposition are largely occupied with technical collections, such as are of special interest only to those with whose business or studies they are connected, here is one that represents the greatest and yet the youngest and most progressive of the sciences, one whose marvels, though surpassing the wonders of dreamland, are presently to be excelled by others yet in store.

Passing from the railway station along the northern side of the central court, the visitor will observe in the spacious portico of a building on his left, a colossal statue mounted on



WIRING APPARATUS



INCANDESCENT APPARATUS

describing this gem of artistic workmanship, with the façade to which it gives emphasis, I cannot do better than adopt the words of one of its artificers, Henry Van Brunt, of the Kansas City firm of Van Brunt and Howe, to whom I am partially indebted for my sketch of other Exposition buildings.

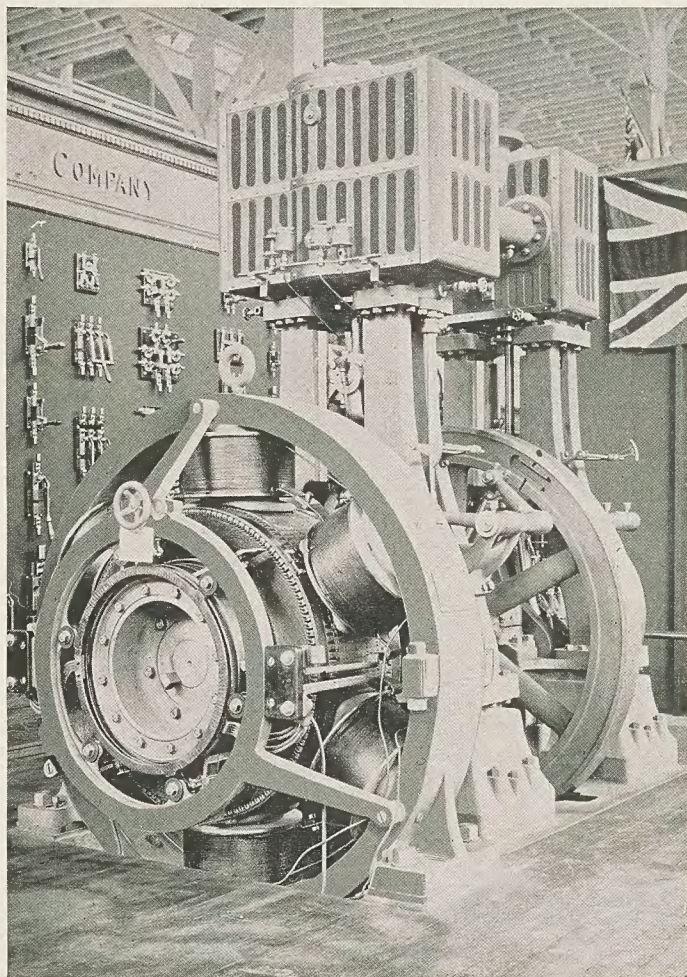
"On the south side," he says, "it was necessary to make a concession to that spirit of grandeur and ceremony which should prevail around the great court of the Exposition. Accordingly the vertical line, predominant elsewhere in the building as a foil to its long, low, horizontal mass, is here subordinate to the spirit of repose. To this end the campaniles on the corners are set back from the front, but connected with it by gabled pavilions, and the principal entrance on this side is treated as a triumphal arch, crowned with a classic pediment containing an escutcheon, which bears the electromagnet as a symbol of electricity, and is supported on each side by a female figure representing the two principal industries connected with this science—electric lighting and the telegraph. Above, in contrast with the somewhat fantastic movement of the skylines elsewhere, rises a solid elevated attic, forming a

a pedestal, and on the frieze above it the following inscription:

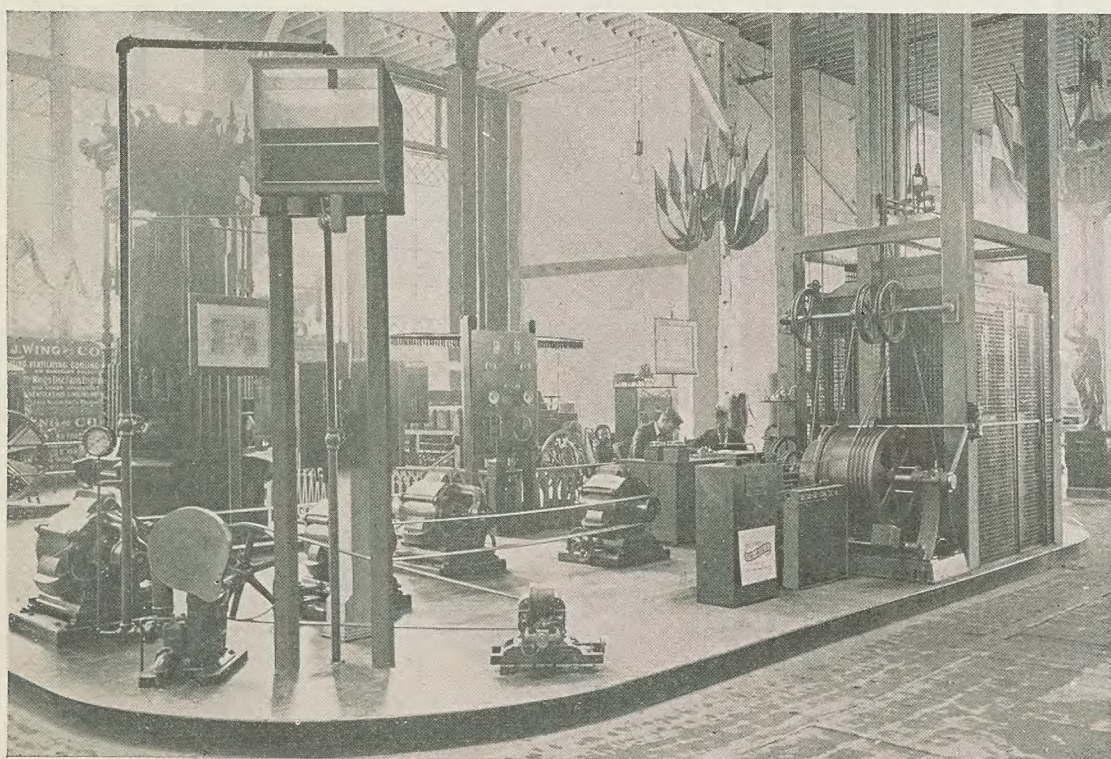
Eripuit Cælo Fulmen Sceptrumque Tyrannis.

In the statue he will recognize that of the great philosopher who, if he did not, as the epitaph would have us believe, wrest from the tyrant his sceptre, was the first to steal from heaven its lightning. Passing through the portal and beneath the arch which encircles it, we find ourselves in the hall of Electricity, an edifice somewhat daring in design, but with such elements of the picturesque as its special uses would permit. Before making further mention of this structure, let us pause for a moment within its portico, for here is one of the main architectural features of the composition.

In des-



EDISON DYNAMO



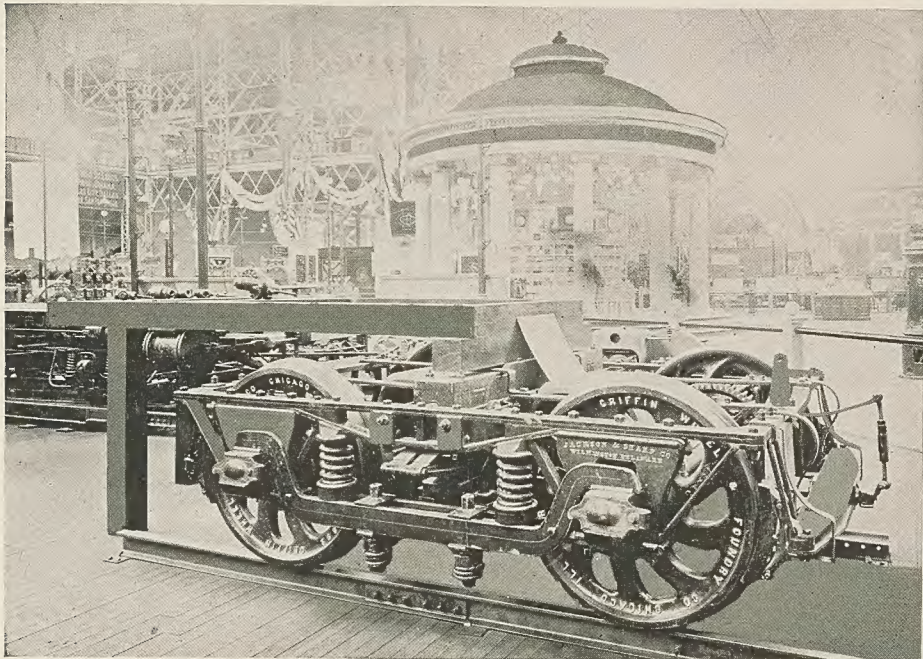
ELECTRIC ELEVATOR

severe horizontal outline against the sky. This central mass is buttressed on each side by great consoles, supporting emblematic statues resting on pedestals, and embellished with medallions of Morse and Vail, the American inventors of the electric telegraph."

In the centre of the great portal is the statue of Franklin, by Carl Rohl-Smith, fifteen feet in height, and one of the best conceptions ever presented of the great discoverer, his gaze turned upward toward the lowering clouds, in one hand the kite, and in the other the key of which all the world has read. Upon the frieze are inscribed in alphabetical order around the building the names of more than threescore electricians of all nationalities,

whose names have become historic, the fame of those who are still among the living resting upon the exhibits within.

In preparing the plan of the Electricity building a space of twenty-three feet was adopted as the unit of measurement, fifteen of these modules forming the interior width of the building, and five that of the longitudinal nave which forms its central feature, the latter intersected by a transept of equal width and height. On each side of the nave are aisles, one module in width, and above is a series of galleries connected by bridges, and to which access is afforded by spacious stairways on either side of the principal entrances. To



EDISON STREET CAR MOTOR

provide for the central areas occupied by nave and transept, both are unencumbered with columns, their pitched roofs being supported by arched trusses of sufficient height to admit of clear-story windows, and with a range of skylights at the foot of the pitch. Flat roofs with skylights cover the remainder of the building.

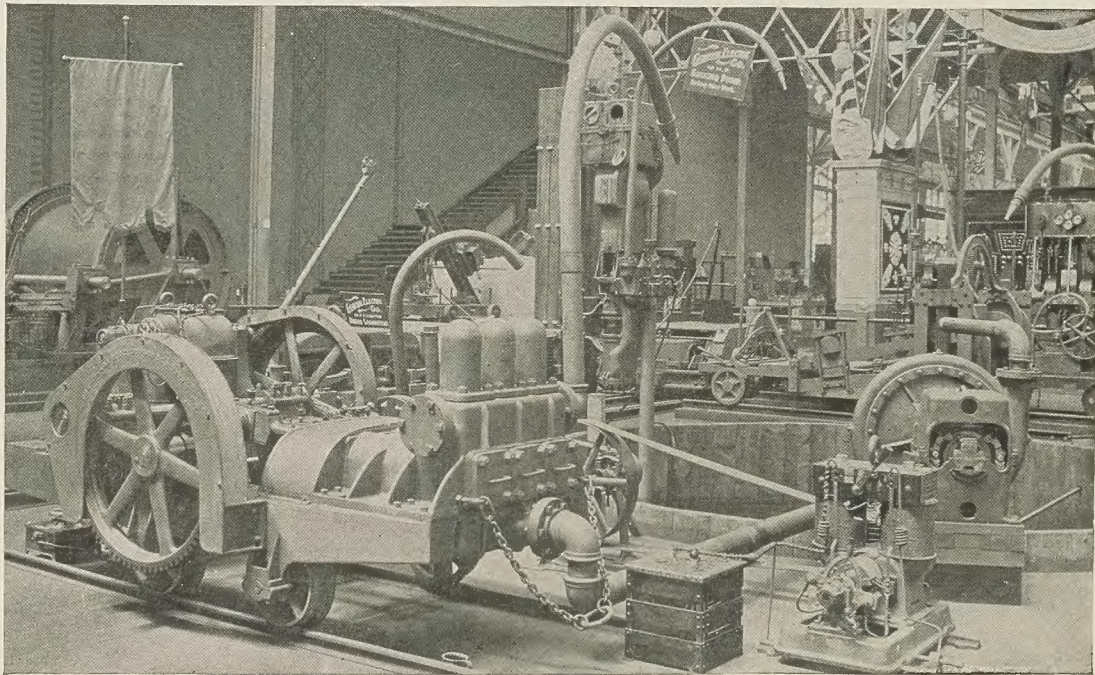
The area of Electricity hall, apart from galleries, is little more than five acres, fronting on the main court 350 feet, and extending about twice that distance length-wise toward the lagoon. Hence in this structure, small by comparison with its neighbors, but only by comparison, it was a part of the design to give to it such features as should mask its inferiority of size. But this could not be secured by giving additional height to the curtain walls, which must not exceed sixty feet from ground to cornice. The bays were therefore fashioned so as to furnish at frequent

intervals bases for towers, and between them pilasters of the Corinthian order, projecting boldly from the piers, and ending in pedestals supporting banner-staves, which served also for a continuous series of electric lights. Further to emphasize the vertical lines of the building, in the centre of its two longer façades the intercepting transept ends in a pavilion, flanked with towers, upon which rests an open belvedere with rounded attic, supporting a cupola, and ending in candelabra of electric lights reflected from the overhanging canopy nearly 200 feet above ground. In front of the pavilions are porticos, with columns more than forty feet high, and also of the Corinthian order. On the north side, where the proximity of the lagoon permits more freedom of style, the portal is placed midway between two semi-circular projections, the towers on either side resembling those of the east and west pavilions, while on the panels of the arch are recumbent figures typical of discovery and investigation. Elsewhere the decorative scheme suggests the purposes to which the building is devoted, helping with the tall campaniles and their intermediate domes, to relieve a too strict conformity to classic models.

While the main object of the Electrical department, contained for the first time in a building of its own, is to display, with competitive tests, the working of electrical apparatus in practical use, it is also intended to present a history of this science from its very inception, with models, and in some instances

the actual appliances used by the earlier inventors. Of the plant located in Machinery hall mention has already been made, and in addition to lighting its power is applied to manifold purposes, among them for the operation of an elevated railway within the grounds, for mining, milling, and metal work, for exhibits of electricity used for artistic effect, and in a word for all the wide field in which electric science has gained a permanent foothold.

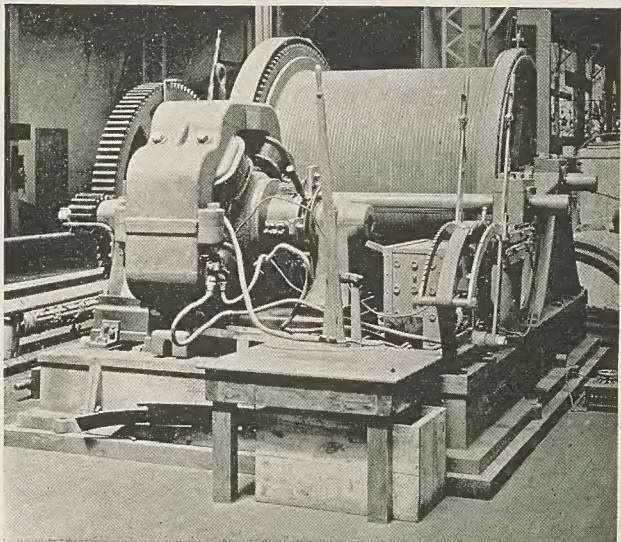
Says the chief of the department: "The general scheme to be carried out is twofold. The exhibits will be practical, and they will also be popular. Every electrical concern and enterprise of any importance in



MINING PUMP



THE FRANKLIN STATUE

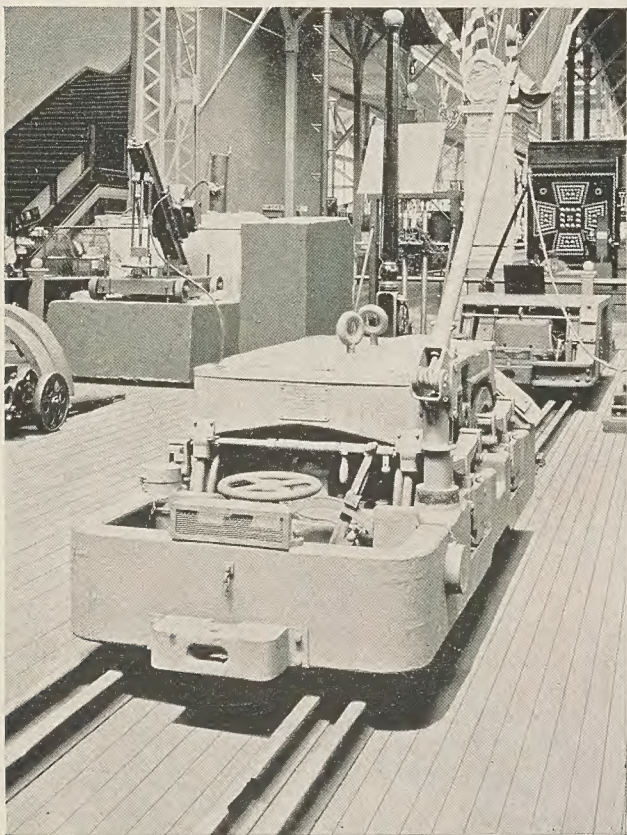


MINING HOIST

The final object is the enlightenment of the people as to the progress of a branch of science and industry yet scarcely out of its cradle, and to foreshadow the possibilities of its future."

In the centre of the building, and forming a part of the exhibits of the General Electric company, is the Edison tower, the so-called tower of light, its shaft encircled by thousands of miniature lamps, arranged in unique design, and with kaleidoscopic effect. Above it is a large incandescent lamp or series of lamps, composed of innumerable pieces of crystal, and at its base a pavilion, surrounded by a circular peristyle, and containing a number of electroliers and globes exhibited by a Pittsburg company, these also illumined at night by electricity. Thus when, at the silent touch of an unseen hand, the tower from base to apex is arrayed in robes of scintillating and many colored lights, we have here the very incarnation of electric science.

In the company's display are illustrated nearly all the uses to which electricity is put, their collection including machinery and apparatus of every description from the smallest of lamps to the most powerful of dynamos, and from electric toys to motors and motor cars. West of the tower of light is a section containing 2,500 specimens of Edison incandescent lamps, such as are made at the company's works at Harrison, New Jersey, and as declared by the highest courts of justice in Europe and the United States, the only lamps that are lawfully manufactured. Lamps are also shown in different stages of construction, illus-

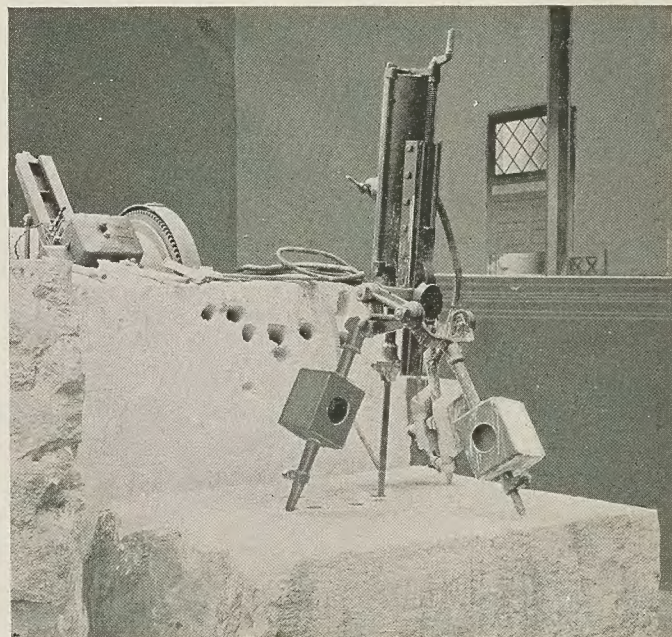


THOMSON-HOUSTON MINING LOCOMOTIVE

the world will be represented. By means of the practical arrangement of the exhibits, by means of their scientific classification, covering the entire field of electrical science, by the opportunities afforded to compare the results of the more prominent electrical systems in supplying electric service for light, power, heat, and commercial purposes, with each of these different systems in actual operation, side by side, and almost under identical conditions, great popular object lessons will be presented, which will not only be intensely interesting to the eye and sense, but will also be highly educational to the electrical engineer, the central station manager, the manufacturer, the student, and the public in general.



ELIHU THOMSON

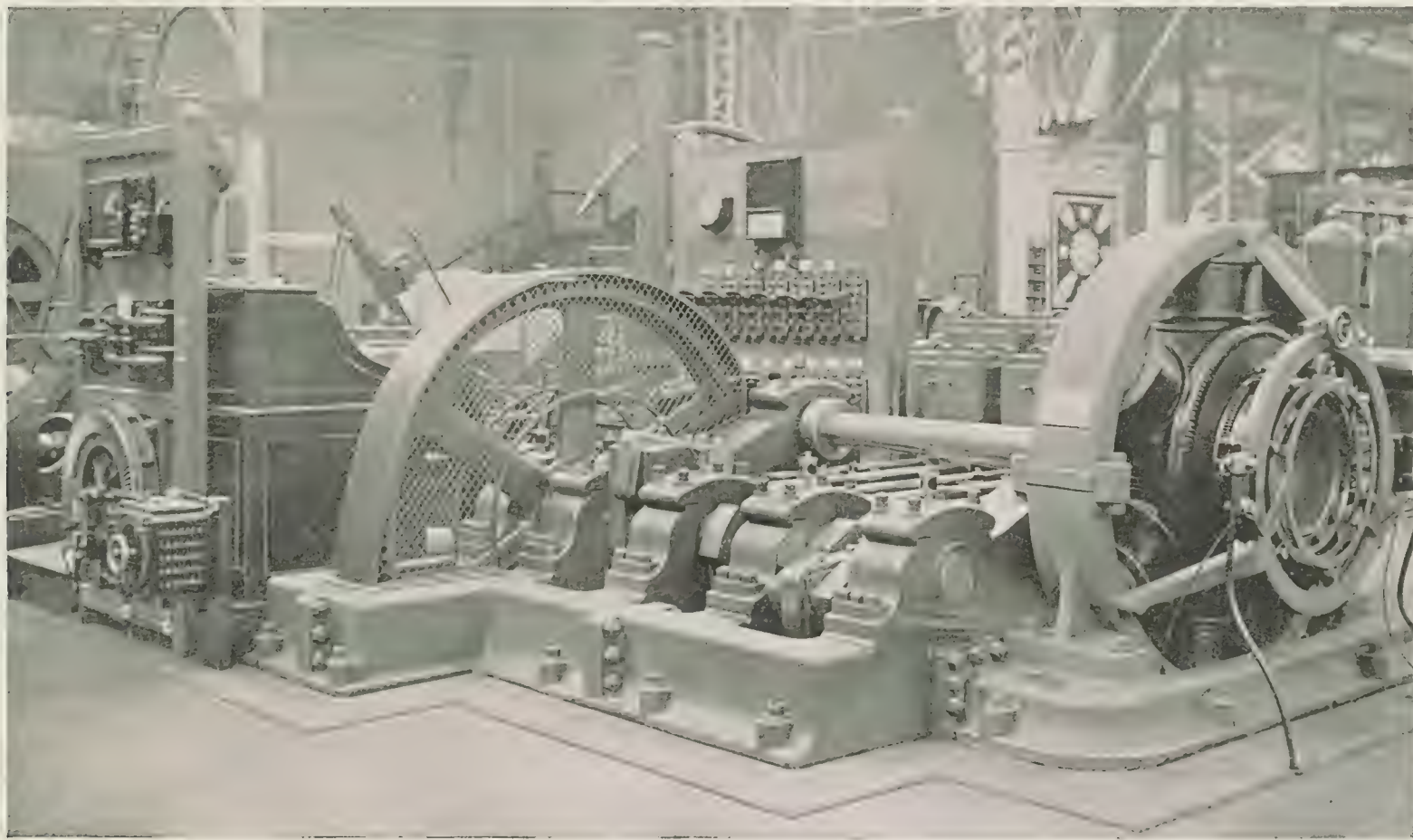


DRILLING BY ELECTRICITY

trating the experiments of the inventor from their first inception to the perfected mechanism of the present day. In one of the compartments is apparatus for decorative purposes, so arranged that the quantity of light consumed can be regulated and registered by meters. In this section also is the first dynamo for incandescent lighting constructed by Edison in 1880 at his works at Menlo park, and near it is one of the dynamos used, some ten years ago, at a New York station of the Edison Electric Illuminating company. Though both are now somewhat out of date, they were regarded at the time as among the marvels of the age. The isolated incandescent lighting systems, such as are adapted to the use of hotels, theatres, and large business buildings are shown in a separate group.

In its eastern section the company displays its Thomson-Houston arc-lighting apparatus in a larger oaken pavilion, containing also carbons of various grades arrayed in geometric figures, with dynamos and other appliances. Elsewhere in this section are the experimental apparatus used by Elihu Thomson for high voltage discharge, with portions of trees that have been struck by lightning showing the path of the bolt.

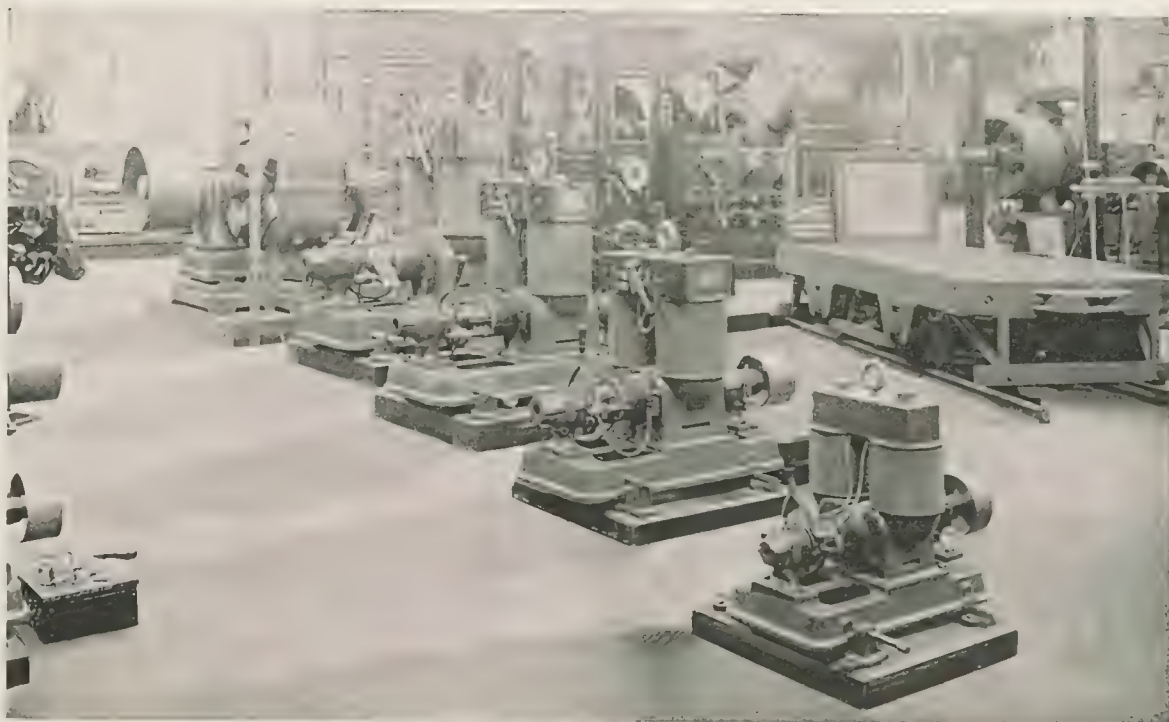
Among the objects of the department of Electricity was to illustrate the possibilities of that science as applied to mining and milling ores, not only in the transmission of power but in its direct application to purposes for which it could be made available. All this is demonstrated in the company's exhibit of machinery and appliances, including engines for hauling rock, mining pumps, hoists, drills, dumps, pressure



ELECTRIC MOTOR AND PUMP

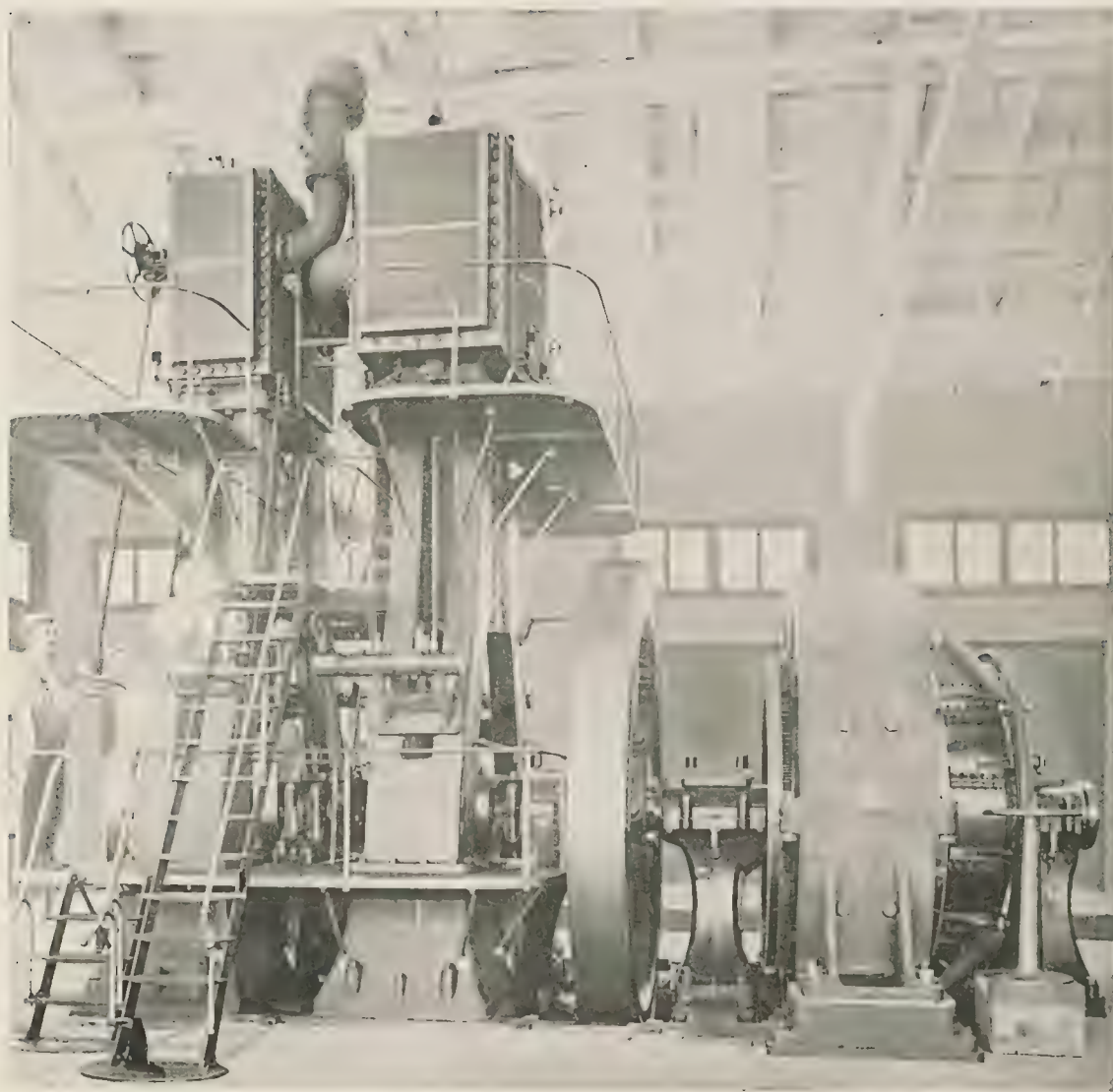
blowers, air compressors, and centrifugal fans, with blocks of stone to show the working of the drills, and a large water tank to display the operations of the pumps. Thus is scientific mining being gradually revolutionized through the use of electric apparatus, which is also largely availed of for the working and refining of metals. Such machinery is rapidly gaining in favor throughout the mineral regions of the continent, from the coal mines of Pennsylvania to the gold and silver mines of Colorado, California, and Mexico. In addition to its more economic and expeditious work, electric appliances can be used to advantage at all seasons of the year, for the current in the wires is never checked by frost, and suffers no loss from condensation.

Southwest of the Edison tower is the company's office, and adjacent to this its display of electric motors for railway purposes, for power transmission, and for general application, with a specimen of such as are used in the electric launches which ply on the waterways of the lake. There are also derricks, hoists, and a large collection of railway apparatus, with photographs displaying among other objects of interest the first electric railway built, as I have said, in 1885. Elsewhere in the company's collection are



A GROUP OF MOTORS

magnets, induction coils, converters, and transformers; instruments of precision, voltmeters, ammeters, and Watt meters; dynamos with direct and alternating currents, and for duplex telegraphic service, and apparatus used for war vessels, and for electrical construction and repair.



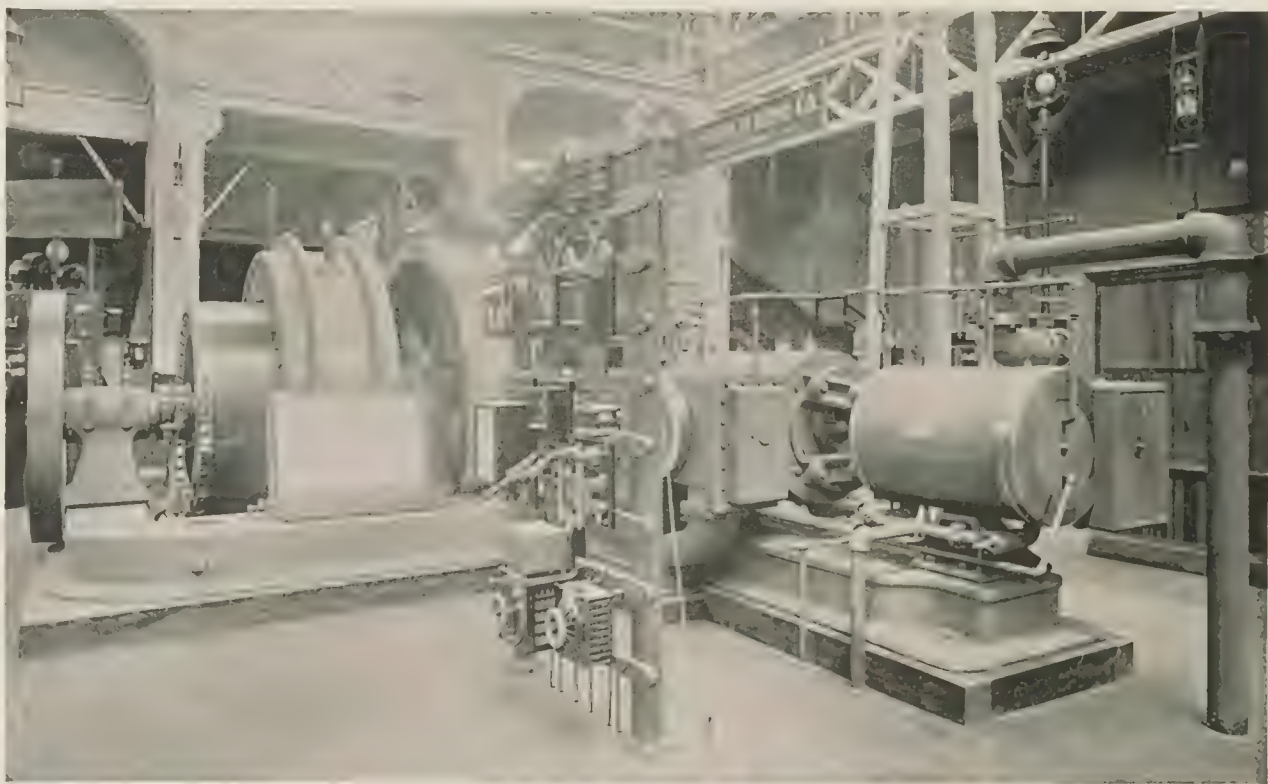
DYNAMO AND ENGINE

Upon the tracks west of the terminal station the company has on exhibition what is claimed to be the most powerful electric locomotive in the world. It weighs thirty tons, is more than sixteen feet long and eleven in height, and has two motors, one at each axle, supplying the power. The locomotive is substantially constructed, its cab being of sheet iron with a fine interior finish of hard wood. Although the engine has been especially devised for railway work, it is proposed to introduce it upon suburban and elevated roads, and upon switching and short freight lines. An electrical air compressor furnishes power for brakes and whistles.

In truth there are few exhibitors more fully represented in the various branches of the Fair. By this company was furnished the equipment for the elevated intramural railroad, with power sufficient to keep in motion on its road-bed eighteen trains at a time, and with accommodation for several thousand passengers. The elec-

tric launches on the lagoons are propelled, as I have said, by its motors, the power being furnished by storage batteries beneath the deck. The huge iron girders and trusses in the Manufactures and other buildings, the monster locomotives in Transportation hall, and the heavier groups of statuary were all placed in position by its motors, which are also largely used for supplying machinery with motive force. Finally the electric fountains and two of the search-lights used for illuminating purposes came from the company's workshops.

Adjacent to the exhibits of the General Electric company are those of the Westinghouse Electric and Manufacturing company, by which was installed in Machinery hall the great power plant used for lighting the Exposition and buildings, capable of supplying simultaneously nearly 200,000 lamps with a total capacity of more than 3,000,000 candle-power. In the collection of appliances for arc and incandescent lighting, prominence is given to its alternating current lighting apparatus; but here and elsewhere are fully illustrated all the more recent improvements in the various branches of applied electricity. An interesting feature in its display is

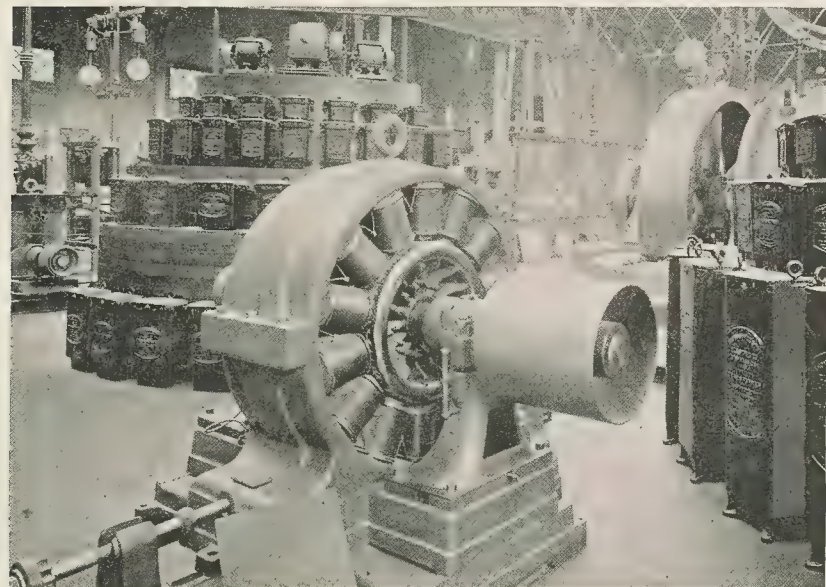


ALTERNATING DYNAMOS

a profile of Columbus, with decorative scrolls and letters, traced in incandescent lamps against a background of terra cotta on the southern wall of the Electricity building.

Elsewhere in its 15,000 feet of floor space, and north of the Edison tower, is a darkened room for the

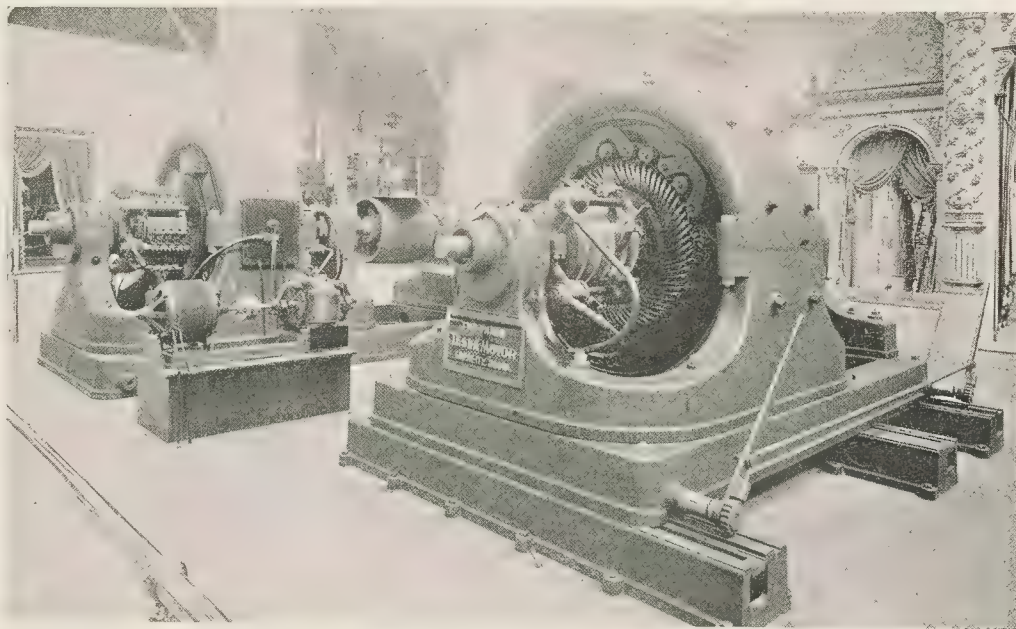
display of what are termed high potential and high frequency phenomena. Adjacent to this we enter, through an archway richly colored in cream and gold, a section containing several of the first motors fashioned by the Austrian inventor, Nikola Tesla, with apparatus showing the results obtained in the use of high frequency alternating currents. Here also is fully illustrated the Tesla polyphase alternating current system for the transmission of power, including a 500 horse-power generator, the switch board at the generating station being connected with the one at the receiving or distributing station by an overhead four-wire circuit. The insulators that support this circuit are of the pattern designed for the San Antonio Light and Power company of Pomona, California, by which power up to 10,000 volts can be transmitted for 28 miles by an overhead circuit of bare copper wire.



A MAMMOTH DYNAMO

collection of street railroad apparatus, with two powerful multipolar generators, one driven by a compound engine, and the other by a belt, with cars equipped with motors of the single reduction type, beneath which are galleries permitting visitors to examine their interior mechanism. There are also lines of switches, ammeters, voltmeters, and circuit breakers, with minor exhibits pertaining to the construction and working of such electric railway systems as those in which the company's cars carry their thousands daily between Chicago and its Fair.

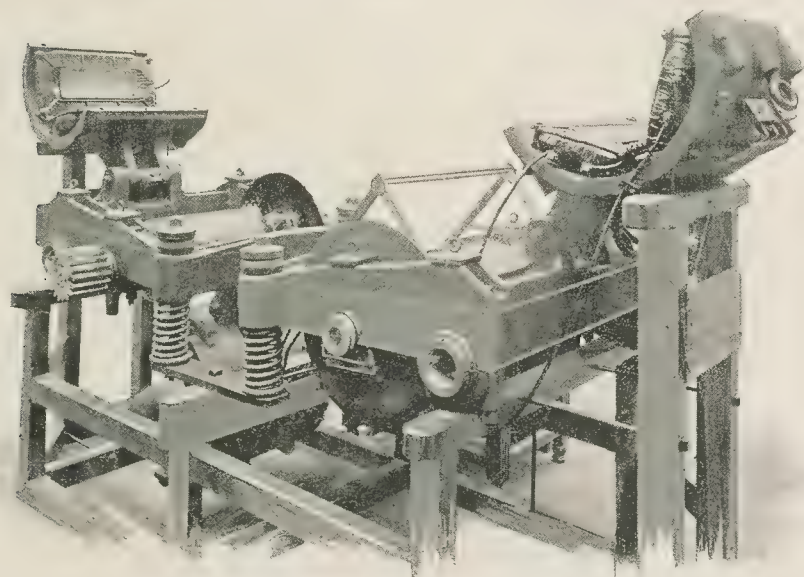
A large area in the southeastern portion of the hall is occupied by the Western Electric company, of Chicago, whose exhibits consist of the apparatus which it manufactures, and the various spectacular effects produced thereby. The column which flashes forth zigzag lightning, around it revolving balls of fire, is one of the ornamental gems of the Exposition, and divides attention



with the Egyptian temple whose exterior walls are decorated with native figures engaged in the manufacture and operation of the telephone, fire alarm, electric apparatus, and other of the company's devices. Egyptians

are manipulating cables, dipping reels of wire into insulating baths, and bearing to their queen, typical of Chicago, lamps, dynamos, motors, batteries, and other appliances.

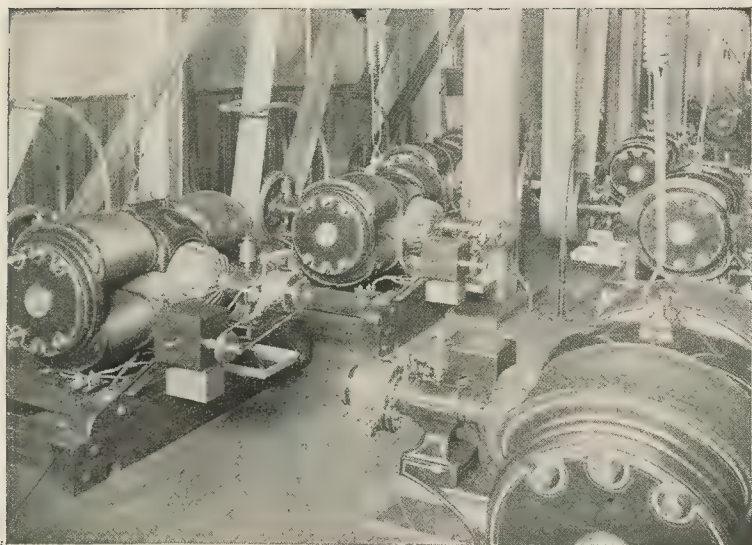
The temple is colored in warm roseate hues, with frieze of old gold and stencilling in Egyptian designs, while lotus blossoms and cut-glass jewels, lighted by hidden incandescent lamps, form the most striking decorations of the main entrances. The interior is divided into two compartments, whose rich ceilings and columns of glass are illumined by more than 1,000 changing lights, their decorative scheme including the lotus, the eagle, and the hooded serpent. Around the walls are show-cases, lined with red plush, and containing apparatus of the company's manufacture, as switchboards, receiving instruments, recorders, galvanometers, a stenographic machine for



STREET CAR MOTOR, WESTINGHOUSE COMPANY



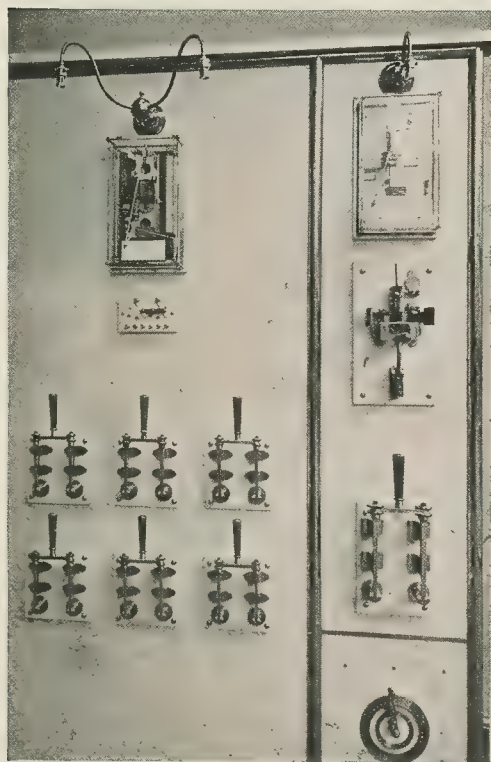
ELECTRICITY BUILDING, NORTH FRONT



DYNAMOS OF WESTERN ELECTRIC COMPANY

company's plant at Machinery hall, half a mile away. Near the switchboard are various machines used by the company in manufacturing processes, including those which make nuts and screws, which insulate wires with silk and paper, braid the strands of conductors, and wind them upon spools, and perform a score of operations formerly done by hand. A complete exhibit of telephone apparatus is a feature of the display, including machines made by its factories in New York, Chicago, and Antwerp, and those constructed for the American Bell Telephone company. There is a large array of switchboards, showing the different styles fashioned within the past decade, with reels of cable covered with lead, and insulated with paper instead of cotton and paraffine.

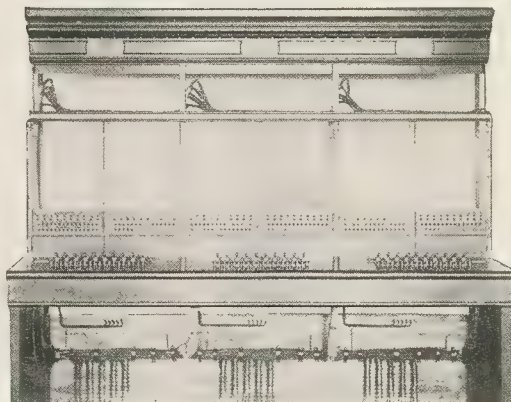
In this section is the tabulating machine used in United States census work, and an ingenious mechanism whose long finger terminating in an incandescent bulb, is continually writing in air the words, Western Electric company. Batteries and incandescent lamps are elsewhere grouped, and a portion of the space is occupied by a small scenic theatre presenting an alpine landscape, over which are cast the changing hues of night, dawn, midday, and sunset, thus showing that with skilful manipulation electric light may be shorn of its coldness and hardness, and endowed with all the rich colors of the natural rays. In a historic collection is a large portrait of Moses G. Farmer, and a handbill dated 1847, advertising the public exhibition of his recently invented electro-magnetic engine. The Farmer electric cars and incandescent lamps are still among the specialties manufactured by the company.



WESTINGHOUSE SWITCHES

the use of the blind, a printing machine for telegraph operators, district telegraph and police call boxes, electric bells and buttons for hotels, elevators, and residences, in short, a collection covering almost the entire range of electric supplies.

But the Egyptian temple and the electric tower by no means complete the company's display. Close at hand is a switchboard composed of slabs of Tennessee marble mounted in bronzed copper, from which issue the currents which supply both these structures, its reverse side showing the various connections, and the entrance and distribution of the circuits which originate in the



TELEPHONE SWITCHBOARD



IN THE WESTINGHOUSE EXHIBIT

Adjoining the exhibits of the Western Electric company is a classic structure, with two large porticos, representing the American Bell Telephone company. At its main entrance is a broad stairway, guarded by two figures of the sphinx, over which are large candelabra of bronze, and a row of Ionic pillars opening into a court containing fountains of tasteful design. Beyond is the temple proper, octagonal in shape, through which one may pass to the opposite entrance, or examine the collections in either of the side corridors.

On one of the walls are tabulated statements showing the growth of the company's business from 1881 to 1893, and from which it appears that in the former year it employed 1,400 persons, and in the latter nearly 10,000; that at the present time it operates more than 440,000 miles of wire in and between the larger cities, and that 552,000 of its telephones are in constant use. The map on which is represented its system of long-distance telephones indicates that Boston, Washington, and Milwaukee are at its extremities with lines between all connecting points of importance.



THE EDISON ELECTRIC TOWER

Telephones for the use of marine divers and those who travel by water are also on exposition.

In a series of cases covering the entire length of one of the corridors is a historic collection, representing the essential features of the telephone first constructed by Alexander Graham Bell in January, 1875, with subsequent improvements; also the Blake transmitter, the Hughes microphone of 1878, and other inventions bearing upon his patents. In the opposite corridor is a central telephone office, with a dozen or more of operators, where one may observe all the workings of what to most of us has long since ceased to be a mystery. Here is also a series of drawings and photographs, showing the underground construction of telephone systems now generally adopted in the larger cities. Within the inner chamber of the pavilion is a life-size painting of Bell, and a gallery of photographs showing the buildings owned or occupied by company. In the north portico beyond is a long-distance telephone connecting with New York, its workings daily exhibited and tested.

West of the space allotted to the Telephone company is a pavilion of Grecian architecture, whose ceiling is colored in imitation of the mid-day sky. Without is a collection of magnets, coils, and dynamos, among the last being a generator such as is used in the Calumet Hecla copper mines. A space of 30 feet along the western side is occupied by the largest switch-board in Electricity hall, specially constructed for exposition, 30 feet in height, and with a capacity of ten circuits and 30,000 lights. The company has also an exhibit of switch-boards for arc and incandescent lights, with electric motors of many kinds, and a large assortment of carbons.

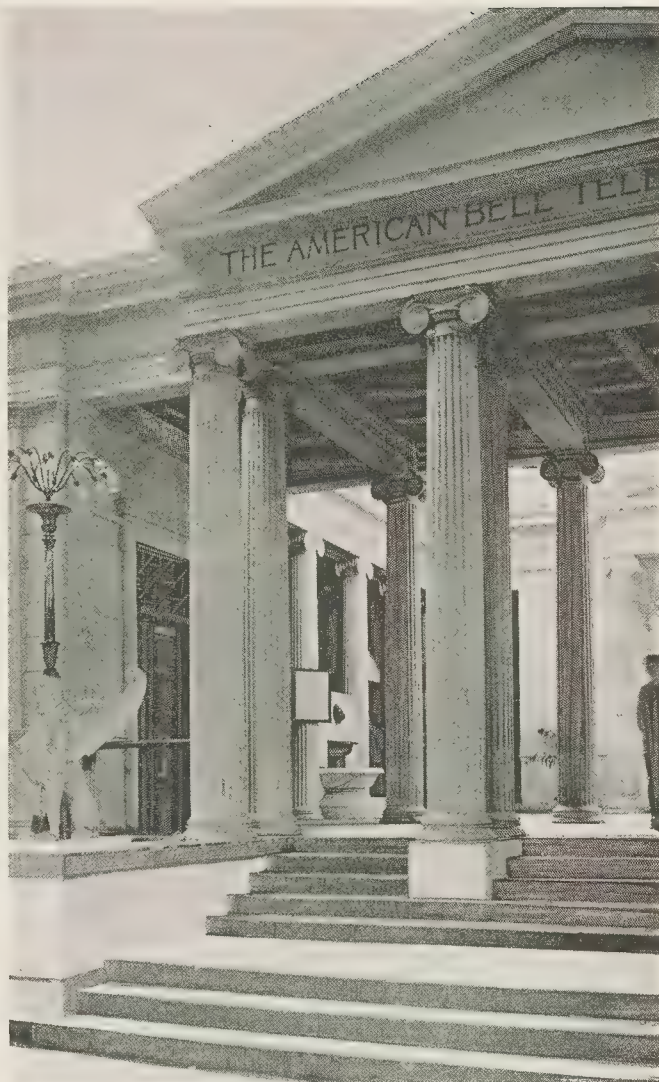
The Fort Wayne Electric company, whose specialty is the manufacture of appliances used in the Wood system, has a large section of this vicinity in which are exhibited dynamos, magnets, generators, switches, motors, meters, and arc, incandescent, and search lights. Here also is displayed the first dynamo built by James J. Wood, in May, 1879, weighing only eighty-six pounds, together with the various lights used in several cities of metropolitan rank in which the Wood system has been largely adopted.

In the groups above mentioned are represented the more prominent manufacturers of electric apparatus and supplies, their collections occupying the southern half of the Electricity building, and a portion of its northern section. But there are

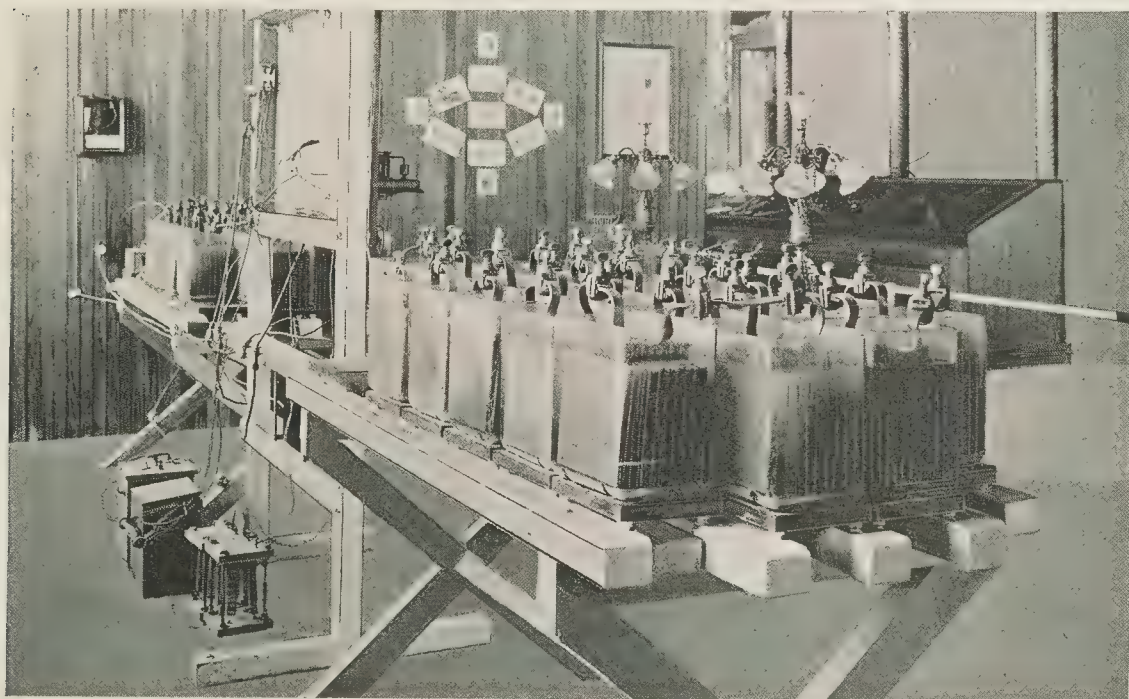
also numerous exhibits of a special, and some of them of a specially interesting character extending in unbroken array along the walls. Before describing them, in conjunction with the gallery display, let us first see what foreign countries have to show on the ground floor of the hall.

Among the German exhibits, occupying a liberal space in the northeastern portion of the building, may first be mentioned those of the Allgemeine Elektrizitätsgesellschaft, or General Electrical society, whose headquarters are in Berlin, but with numerous branches elsewhere in Germany and other European countries. In the

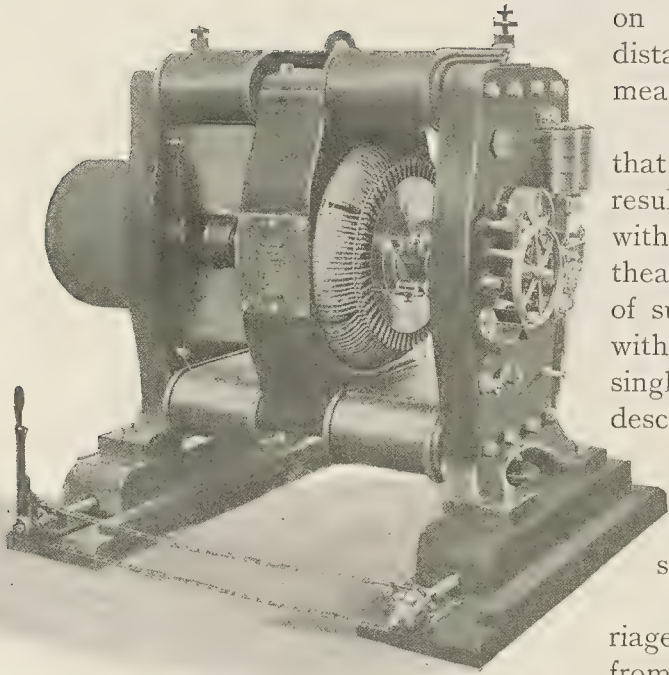
centre of its space are machines for the combined transmission of power by continuous and multiphase currents, the former being supplied by a large electro-motor, furnishing 100 horse-power and making about 500 revolutions to the minute. By means of such currents power has been transmitted from Lauffen on the Neckar to Frankfurt-



ENTRANCE TO BELL TELEPHONE PAVILION



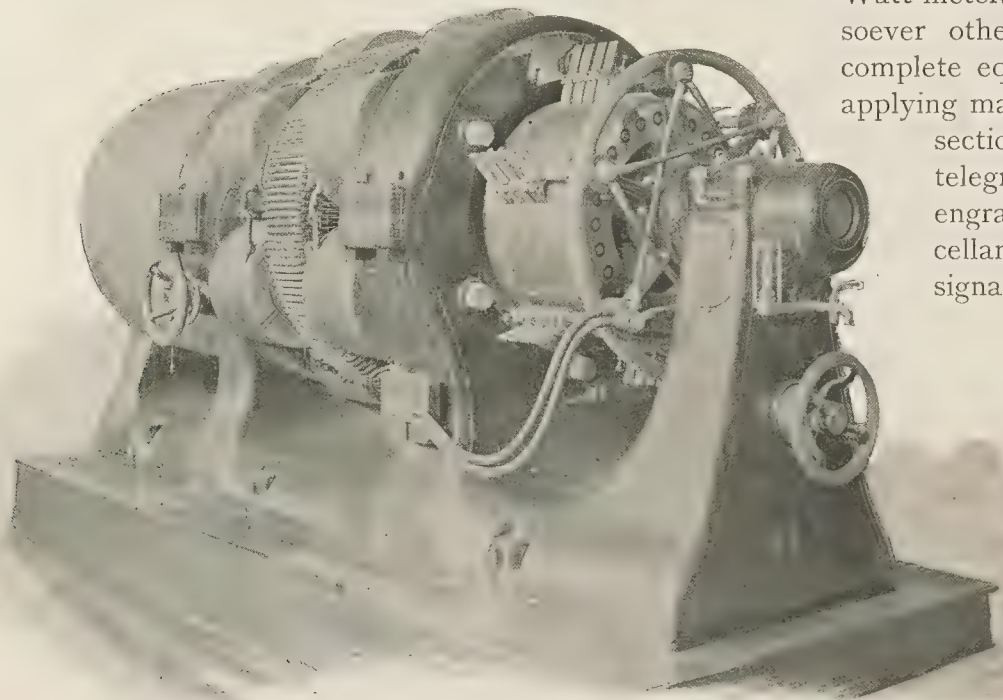
ELECTRIC BATTERIES



WOOD ARC DYNAMO

without flickering, with a clearer, steadier light than those in ordinary use; there are surveying and measuring instruments, and in the gallery is a collection of historic apparatus of which mention is made elsewhere in this chapter.

Among the exhibits by the Nuremberg firm of Schuckert and company the most remarkable are the great searchlights on the roof of the Manufactures and other buildings, as described on a former page. Felten and Guillaume of Carlswerk have a large assortment of wires and cables in coils and cross sections, many of them arranged in the form of pyramids, with barbed, braided, and other wires of many varieties and in many forms. Hartmann and Brown have numerous specimens of apparatus, manufactured at their works near Frankfort on the Main, where are produced surveying and measuring instruments, galvanometers, magnetometers,



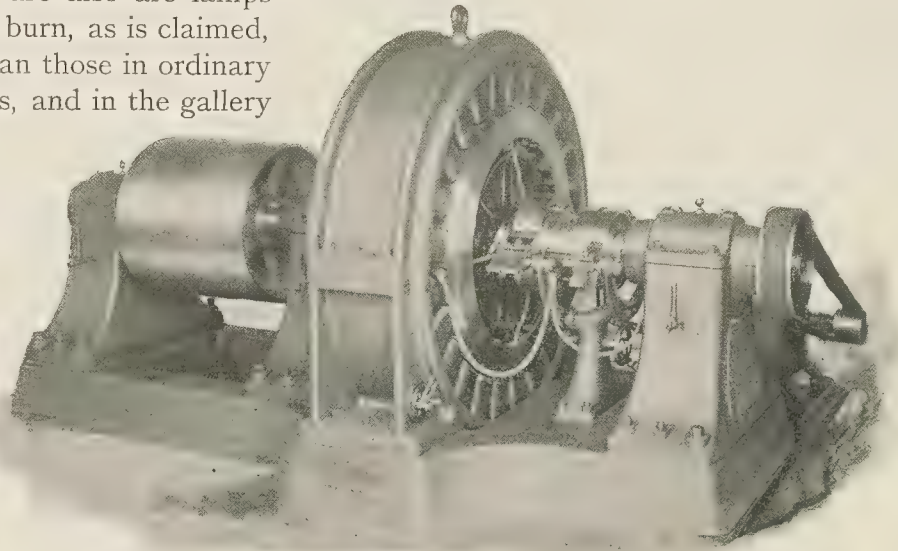
DISPLAYED BY THE SHORT COMPANY

for ascertaining the resistance of electric currents, and for measuring their speed. The multiplex telegraphic system of E. Mercadier, director of the polytechnic school, is illustrated by a collection of apparatus. By means

on the Main, more than 100 miles apart, this being the longest distance to which electric power has been transmitted, though by no means the limit of distance.

An interesting display is the stage-lighting apparatus, so arranged that its action may be observed from any point of view. This is the result of many years of study and practical experience in collaboration with specialists, and is now being largely used in German and other theatres. By it are produced the broad glare of noonday, the glow of sunset, the silvery shades of moonlight, and the grey hues of dawn, with lightning flashes and other intermittent phenomena, all by a single instrument connected with colored lamps. Of arc and incandescent lamps there is also a number of specimens, with motors and materials for electric railways, apparatus for storage batteries, conductors, conducting and insulating materials in many varieties, measuring and controlling instruments, electric clocks, railroad signals, and appliances for heating and cooking.

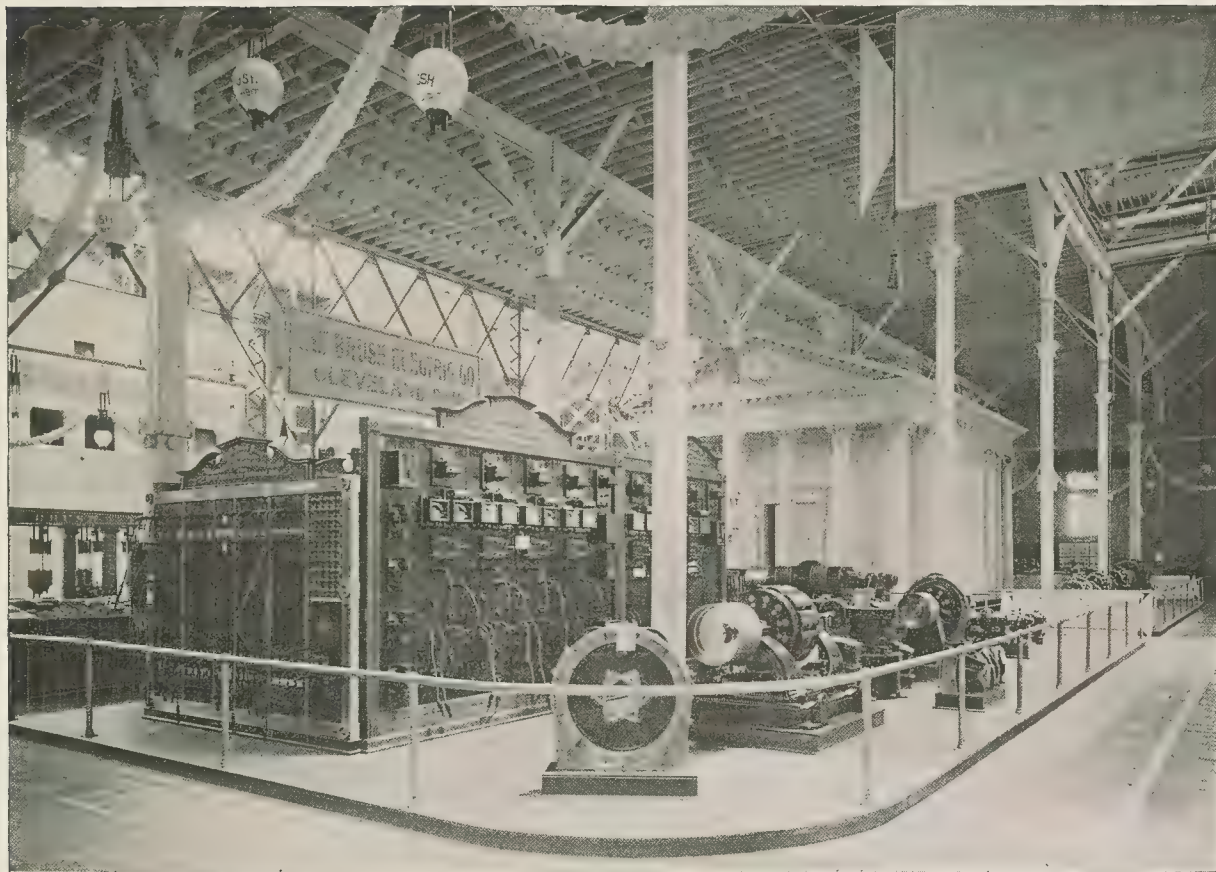
By Siemens and Halske of Berlin is exhibited a railway carriage, driven by a three phase current motor, the current transmitted from a distance, and reduced by a transformer to the strength required. There are also arc lamps which burn, as is claimed,



THE NEW WOOD DYNAMO

Watt-meters, volt-meters, ammeters, pyrometers, and whatsoever other meters are known to electrical science, with complete equipments for laboratories, and mechanisms for applying magnetic tests to iron. Elsewhere in the German section are machines and lamps for electric lighting, telegraph and telephone instruments and appliances, engraving and electro-plating apparatus, and miscellaneous exhibits, as of burglar and fire-alarm signals, lightning rods, and electric toys.

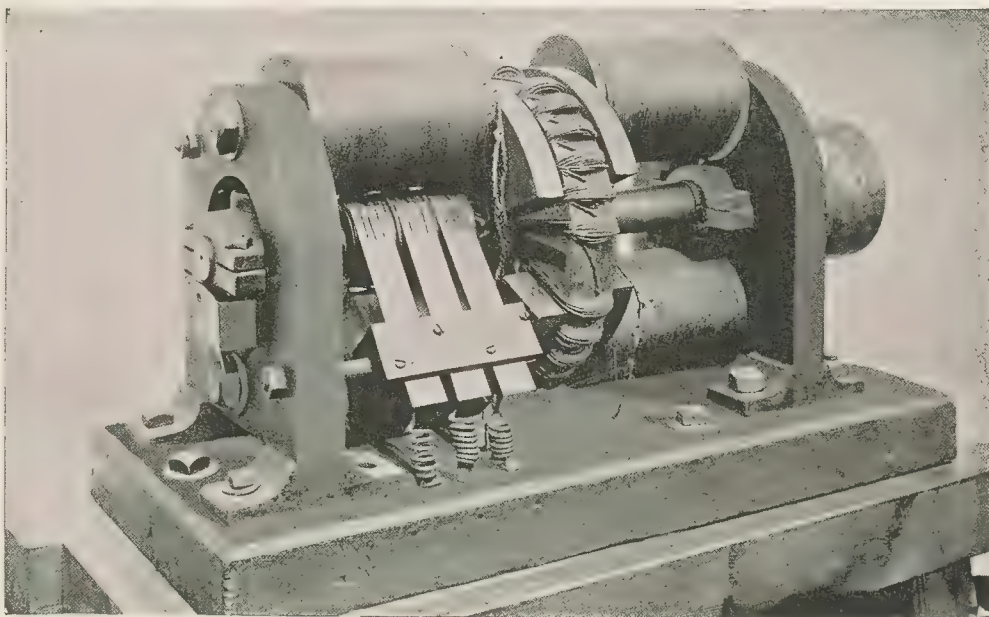
The French section adjoining on the north the exhibits of the General Electric company, contains both national and private collections, the former chiefly in the northwestern corner of the main floor. Here are explained the telegraph and telephone systems organized and operated under government control, and there are self-acting instruments registering changes in temperature, atmospheric moisture, and direction of wind. In one of the cases are machines for testing cables,



of rapid alternate currents it is possible to use the same wires with multiplex and simple instruments, the former transmitting twelve telegrams in one direction, or transmitting and receiving the same number simultaneously. Mercadier and others have several multiplex printing machines, and there are automatic transmitters, a sextuple telegraph, and a model Morse station of four lines. A curious instrument called the Caselli autographic telegraph, patented in 1864, has for its object, as yet only partially realized, the fac-simile transmission of writing.

On the walls of this section are maps showing the routes of telegraph and telephone lines, and diagrams illustrating the development of the telegraphic system since 1851. As the exhibit is specially made by the department of posts and telegraphs, pictures are also shown of the quarters occupied by the government telegraph force. This consists of about 900 employés, the department representing a system which embraces 178,000 miles of wire, and despatches 40,000,000 a year of telegrams. To the telephonic systems there are more than 11,000 subscribers.

Among the private exhibits are large collections of apparatus for lighting, power transmission, and miscellaneous purposes. A prominent feature is the appliances used for lighthouses, with the most powerful of reflectors and revolving beacon lamps, casting a blinding glare as seen at night in operation. Of special interest also is the electric cupola and furnace of M. Moissan, in which that young French scientist has developed a heat up to 9,000 degrees of Fahrenheit. By A. Piat and Sons of Paris and Soissons is displayed a hydro-electric riveter, driven by a combination of hydraulic pressure and electricity, and largely utilized for bridge work. For this and other riveting machines manufactured by the firm special advantages are claimed, some of them having been used by the department of public works, as for the erection of 1,000 feet spans over the river Loire. Elsewhere in the French section are exhibits similar to those of Germany and the United States, together with such scientific curiosities as electric matches, musical appliances, and apparatus for towing vessels, based on the principle of magnetic adherence.



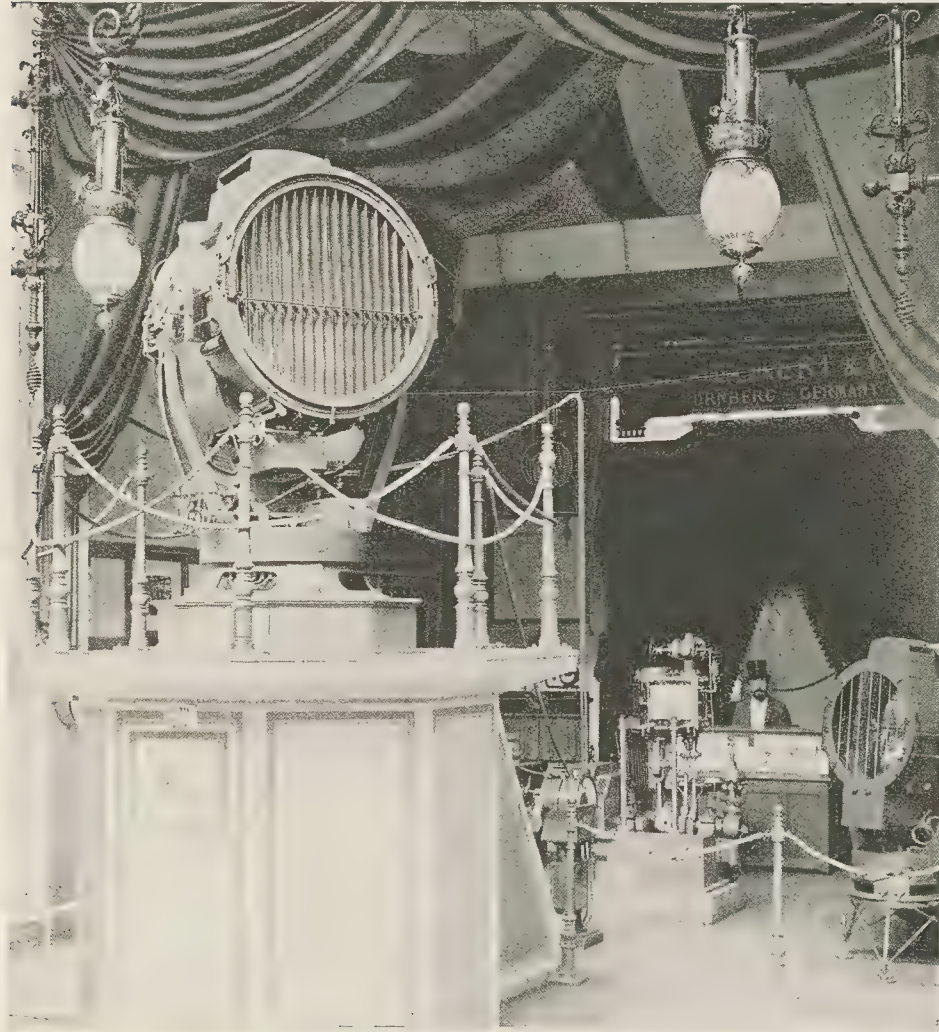
A BRUSH DYNAMO



NICKEL PLATING MACHINERY

In the British section, west of the French exhibits, the most attractive feature is the collection of telegraphic apparatus contributed by the government, dating back to 1837, including the first specimen of underground telegraphs, and the earlier needle and other primitive instruments, all contrasting somewhat strangely with the modern appliances at their side. Add to these a few private exhibits, with those of the London branch of the

General Electric company, and we have about all that Great Britain has to show us in this department. Among the former may be mentioned the display of the Homacoustic Speaking Tube company, consisting of attachments for voice tubes, and a homacoustic commutator with electric signalling device.



ONE OF SCHUCKERT'S SEARCH LIGHTS

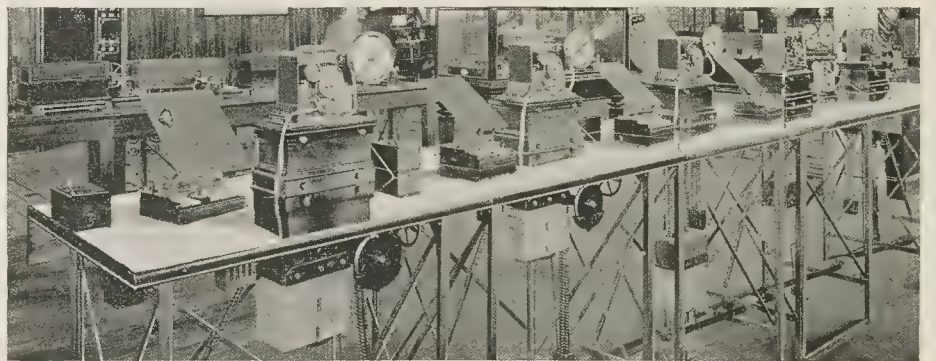
collection of silent and motionless instruments which have a deep meaning to the Japanese and all other peoples who live in dread of earthquakes. It represents the exhibit of the Earthquake laboratory of the imperial university of Japan, and the instruments, known as seismographs, were invented partly by natives and partly by Europeans, not only to record the direction and violence of shocks, but to foretell their approach by indicating the slightest tremor of the earth's surface. The first earthquake instrument ever constructed, a drawing of which is displayed on one of the walls, is claimed as a Japanese invention, and bears date A. D. 132. In the more perfect machines of the present day the main feature of their construction is that during seismic disturbances they work from stationary points, and for minor shocks at least the diagrams written on smoked glass and paper are considered by scientists to be true measurements of the earth's motions.

Many instruments are here exhibited, of different patterns and intended for various purposes. Upon the slightest disturbance of the earth the electric circuit is closed, and the machinery set free which drives the recording surfaces on which the diagrams are written. In one style of instrument this consists of a smoked glass revolving plate, the lines being written upon it by horizontal pendulums and vertical spring levers, both motions of the earth being thus registered. But whether the record is made in this fashion or by pencils upon bands of paper wound on drums, the machinery is kept in motion by electric clock-work, the rate of revolution is marked by an electric time ticker, and when convulsion or tremor ceases the current is broken and the mechanism ceases to work.

Special instruments are used to record violent motions, wave-like undulations, and small, local displacements. A type of the last named is known as the mantel-piece seismograph, and is intended for the use of those who simply wish to know the direction and nature of motion as recorded at their own residences. The tromometer

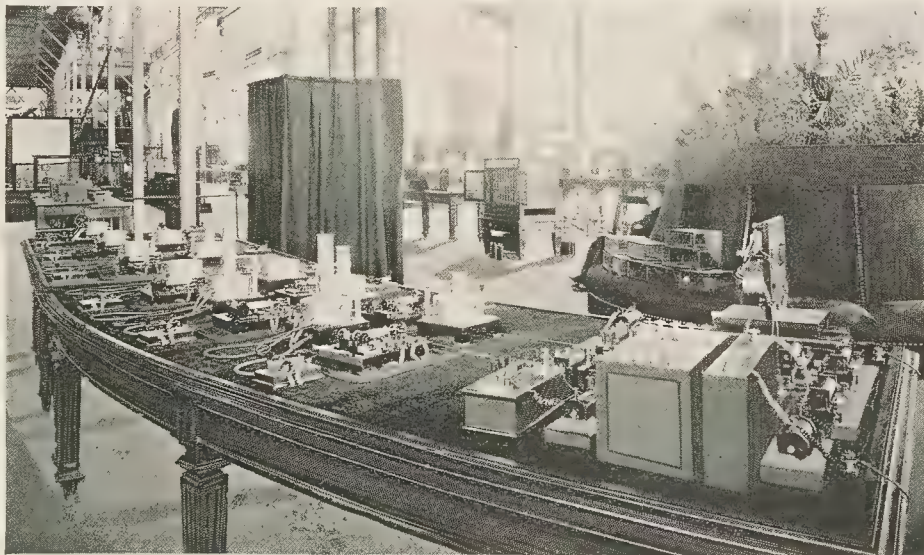
Near the northwest corner of Electricity hall is a tasteful structure, the purpose of which, except for ornament, does not appear until approaching close to it we find here a tower-like fabric composed almost entirely of carbons, cored and solid, and varying from an eighth of an inch to three inches in diameter. This is the exhibit of the Vienna firm of Hardtmuth and company, one of the largest of European manufacturers, and by which have been overcome the more serious difficulties in supplying a carbon adapted to modern conditions. Though more expensive than those of American make, it is claimed that this is more than compensated by superior efficiency, and thus it is that from the agents of the firm large quantities were purchased for use on the incandescent circuits within the Exposition grounds, for the illumination of the central court and basin, the electric fountains, and the battle-ship *Illinois*.

In the northeastern portion of the hall, near an array of noisy phonographs, is a



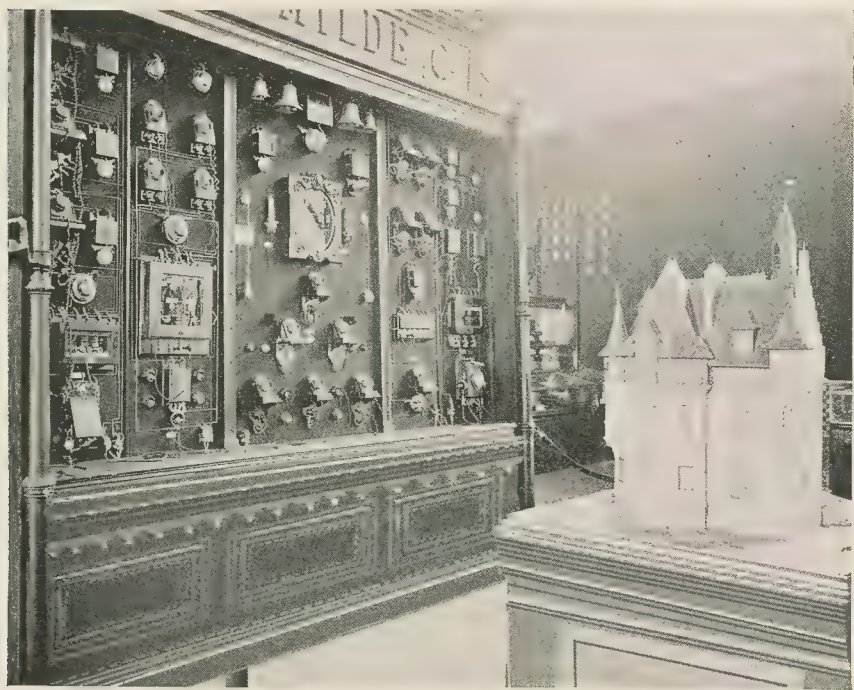
BOUDOT'S PRINTING MACHINE

is one form of an instrument used to record slight earth tremors, such as are common to many countries. Its essential feature is a delicate pointer from which electric sparks are discharged upon a band of paper, automatically moving across a brass table. If the pointer and the earth are at rest, then the holes which are burned are recorded in a straight line; otherwise, the bands of paper are perforated in all directions around what would be the normal line. A more satisfactory and recent method of registering these motions, is by means of a continuous photograph of a ray of light reflected from a small mirror attached to an extremely delicate horizontal pendulum. There are also in this group a clock for recording the duration of an earthquake, and several safety lamps which, if overturned, are at once extinguished. Under a glass case is a mass of wire, bent and twisted in all directions, representing the trend of the shocks during the great convulsion of January 15, 1887, the numbers at different points indicating the seconds of their duration.



MERCADIER'S MULTIPLEX TELEGRAPH INSTRUMENTS

Near the collection of instruments from the seismological laboratory is a series of pictures representing ruined buildings, dark fissures in fields and valleys, bridges hurled into rivers, and other effects of such convulsions as those of 1887 and 1891. Here alone is a sufficient explanation of the interest taken by the Japanese in the study of seismic phenomena, whereby they hope eventually to obtain such scientific data as will enable engineers to build structures that will withstand the strongest shocks and the most complex motions of the earth.

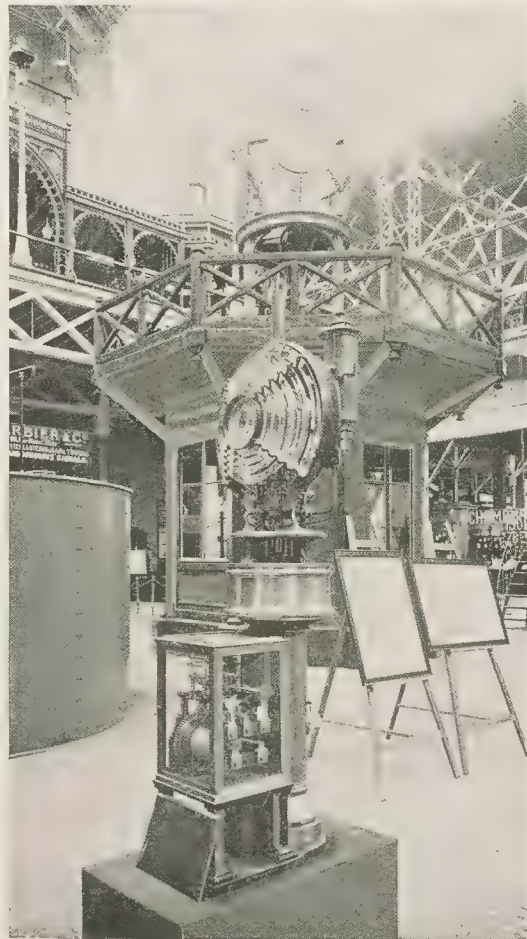


FRENCH TELEPHONES

be operated either by electrical or water power. By the former process it is claimed that coffee may be ground at a cost of five cents for every hundred pounds. Other of its exhibits are a combined water motor and dynamo, and a combined engine and dynamo, both of which are among the most powerful mechanisms of their kind.

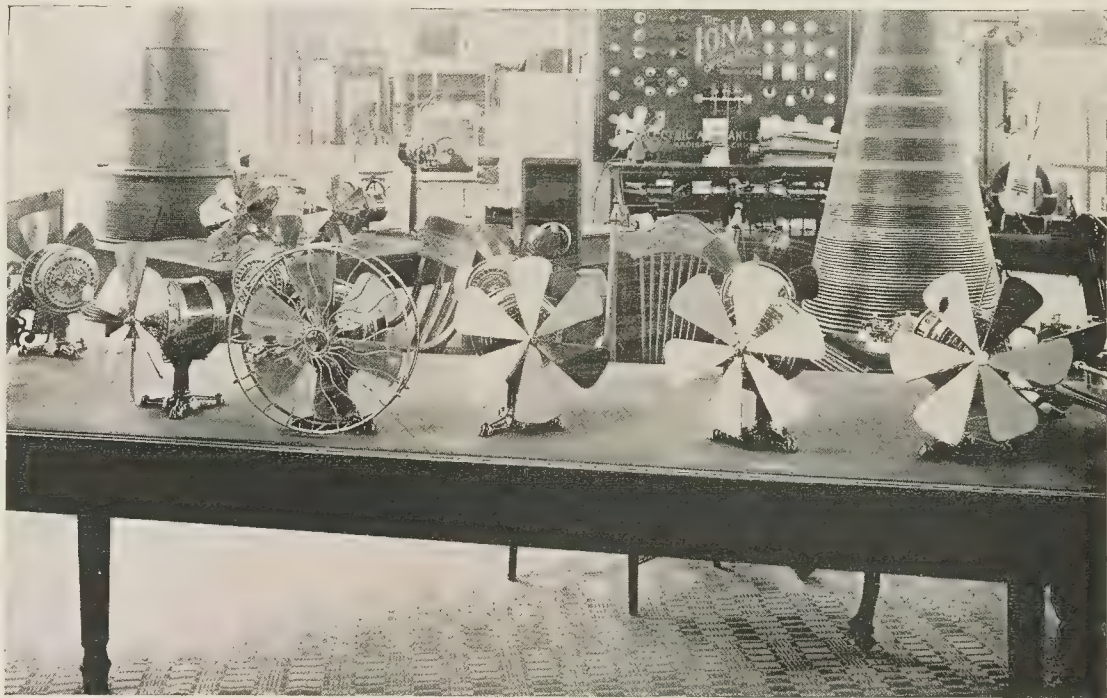
On either side of the southern portal are exhibits of motors, the largest by an electric motor company of New York, which has also fans for ventilating ships and large buildings, with blowers for forges and furnaces, pumps for mining operations and water works, travelling cranes and hoists, organ bellows, elevators, mill machinery, and telephone and telegraph apparatus. Opposite is the dainty bronze pavilion of the Indianapolis company, another manufacturer of electric power machinery. Near the western entrance of the hall, the company which operates the movable side-walk at the lake pier has a large collection of generators, motors, dynamos, and appliances for incandescent and arc lighting. For its so-called Novak lamp, outlined on the pavilion in letters of light, it is claimed that this is the only incandescent lamp that retains to the last its original candle power.

Electric motors, with their application to street, underground, and mining railways, and to machinery in general, are displayed in various portions of the hall and galleries, as well as in the Machinery and Transportation buildings. On the ground floor a factory at Portland, Maine, has among its collection a coffee mill which can



LIGHT HOUSE REFLECTORS, FRENCH SECTION

The largest manufacturers of electrical machinery who exhibit in the body of the hall, make a specialty of supplying street, underground, and elevated railroads, with their operating apparatus. There are also several companies whose operations are restricted to these specialties, a Cleveland firm displaying one of the simplest of all such mechanisms, a single motor suspended on rubber cushions from the truck frame, so protected that it cannot be injured by heat or cold, dust or gravel, water, snow, or slush. Another company shows a gearless street-car motor, for which it is claimed that few of its appliances will either wear out or injure any of the surrounding parts.



ELECTRIC FANS

Near these exhibits is a collection of machines made by an electric welding company, of Boston, and largely used by manufacturers. The current is made to pass through the ends of the metals that are to be

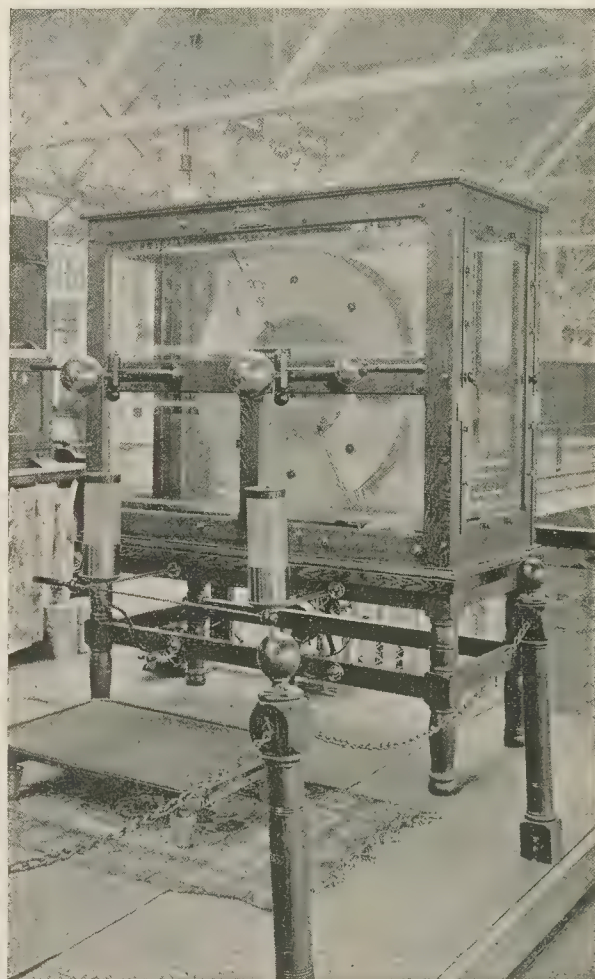
welded, the heat being generated at the point of contact, and whether it be required to fasten strands of wire or the links of a watch chain, or to forge steel projectiles of war, the joints of rails, or the chain armor of an iron clad, the result is uniform. Shells and other projectiles used by the government are welded by this company, and there are here on exposition sheets of wrought iron, four inches thick, which have been pierced by shells at a distance of ninety feet, their lines of juncture still remaining intact. Thus also are welded metallic coils; fences and wheels are thus welded, the several processes being daily illustrated by machinery in operation. Side by side with small machines worked by hand are those whose beds are many feet in diameter, but the adjustments of each are so perfect that in every instance the welding is performed with the utmost precision.



PYRAMID OF COPPER WIRE

On the opposite side of the hall is another exhibit by a Boston firm, which also forges by electricity. Both companies manufacture switches, rheostats, safety appliances, and various apparatus for the transmission and regulation of the electric current, and by several companies are displayed cement-lined pipes and

other conduits, chiefly for underground service. Makers of insulated cables and wires, tapes and compounds are mainly represented in the galleries, but on the ground floor a Massachusetts company has specimens of its so-called insulac, claimed to be impervious to oil and other substances which interfere with electrical circuits, and said to possess four times the resistive power of the finest grade



THE HOLTZ INDUCTOR

of shellac. As the discovery of a perfect insulating compound is one of the problems of the day, such exhibits are of special scientific interest.

In various sections surrounding the main body of the hall is machinery, at times in operation, for electrotyping, plating, gilding, and nickeling, with such as is used for separating metals from their ores or alloys. A Chicago company shows the first electro-magnetic machine, made in 1844 for an English firm, claiming that

its own apparatus is in the line of direct succession. Besides electrotyping and electro-plating, this company makes a specialty of polishing, lacquering, and buffing, a section of a walrus hide, thick and firm as a board, showing the chief material for the wheels used in these branches of work.

In the construction of electrical apparatus, as of other machinery, belting plays an important part, and here are on exposition many varieties specially made for operating dynamos and engines. Some of the belts are fastened with cement, and others with wire screws, but as a rule belting for heavy machinery should be perforated, and of such there is a



GRAY'S TELAUTOGRAPH

large collection. By a New Hampshire firm is exhibited what is claimed to be the largest piece of link-belting in the world, 200 feet long by five in width, with a weight of 4,200 pounds, and in the construction of which were used more than 400,000 pieces of leather and metal.

Of the special mechanisms displayed in the galleries there are also a few exhibitors on the ground floor, their groups including appliances for lighting purposes, for surgery, dentistry, and the diagnosis of diseases. Among the first is a small battery and spark coil which can be attached to burners and used for lighting or turning off gas. This, it is claimed, is cheaper than matches, for the battery will last a year, and can be

replaced for twenty-five cents. The largest exhibits of surgical and medical instruments are by a New York company, which confines itself to such as are used for cauterizing and diagnosis, and by a Philadelphia establishment which also covers this ground, and produces besides small dynamos, batteries, coils, condensers, voltmeters, testing keys, and the numerous minor forms of electric apparatus used by educational institutions.

In the western galleries of the Electricity building are some of the most interesting of its contents, for here are several of the more remarkable among recent inventions. First of all may be mentioned the telautograph of Elisha Gray, who shares the honors with Edison and Bell in the domain of electricity. In 1887 he completed and later simplified the

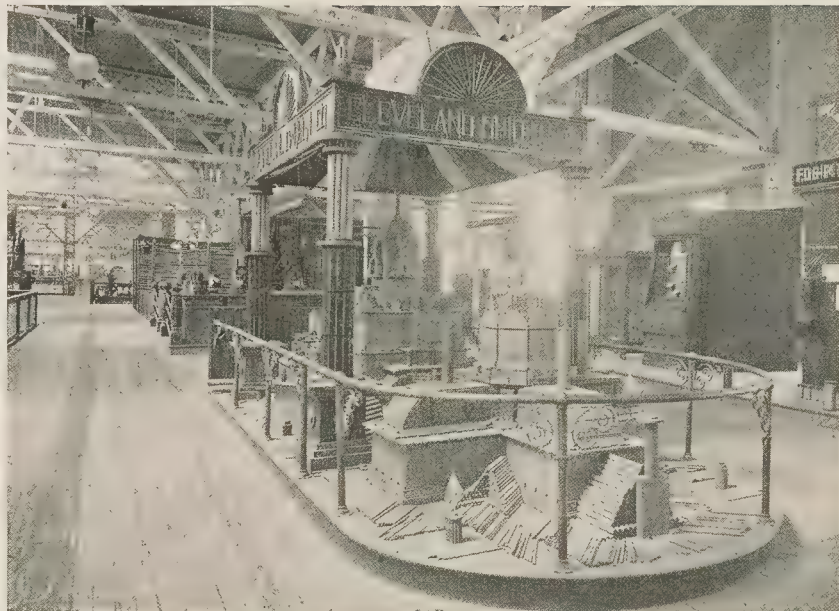


EDISON'S PHONOGRAPH

machine by which fac-simile writings or drawings are transmitted. As now exhibited, it consists of two instruments at either end of the telegraph line, both contained in a wooden case somewhat smaller than a type-writing machine. To the transmitter is attached a pencil, and near its point is a collar, to the opposite sides of which are fastened two silken cords, passing thence at right angles around a small drum, revolving on a vertical shaft,

to which is attached a toothed wheel, the latter, as it turns with every motion of the pencil, acting on the wire with which it is in contact. Two wires are thus required to transmit the writing, the escape-wheel of the receiving instrument responding to every motion of the drum, and the toothed wheel of the transmitter. At the receiving end of the line the order of the mechanism is reversed, the wheels being mounted on the shafts above the drums, with cords running from the latter to aluminum pens of the self-feeding or fountain type. As the wheels and drums are of the same size, the record made by the receiver is a fac-simile of the transmitted manuscript. The invention is of special value not only to business men, but to journalists, and those engaged in the detection of criminals.

In addition to the Edison exhibits of electrical appliances, forming a portion of the General Electric company's display, is a section in the southwest



TEMPLE BUILT OF CARBONS



DAY'S KERITE PAVILION

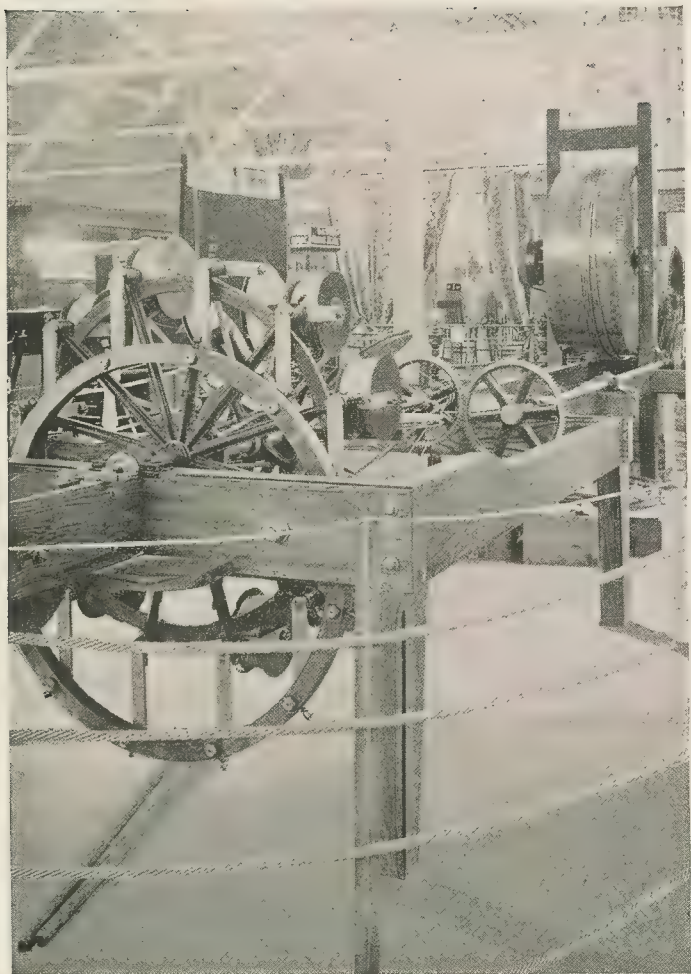
of tin foil then used for the purpose has given place to the hollow cylinder of wax, upon which, as it revolves, the point of the diaphragm cuts the lines of sound. Apart from the amusement derived from this machine, it is rapidly finding favor among professional and business men, taking the place of the amanuensis, while through its records scientists are enabled to make a more thorough investigation as to the nature of wave sounds.

In a brilliantly lighted pavilion is the ingenious exhibit of the Commercial Cable company, representing an enterprise founded nearly a decade ago by John W. Mackay, of California, and James Gordon Bennett, of New York. In general terms, it consists of a working model of their system, showing automatic transmitters, recorders, and other instruments of most approved and modern type. The hair lines of the recording machine are produced at the rate of about one yard per minute, the message being ground out from the other end by the automatic sender. Instead of being transmitted from New York to Europe via Nova Scotia and Ireland, the words are simply conveyed across the pavilion, but for all practical purposes the illustration is complete. In this collection also "faults" cut out of cables, showing the nature of the accident or defect one of the specimens having been crushed into an almost shapeless mass, and nearly severed by an ice-floe. There are also instruments for detecting breaks and injuries from whatever cause with a

gallery containing the instruments of the Edison Manufacturing company; and in this locality, more perhaps than elsewhere in the Exposition, is represented the genius of the inventor. When first it was reported that Edison had constructed a machine which would store conversations, speeches, songs, orchestral music, and any other sounds given into its keeping, and reproduce them at any future time there were many who refused to believe it, and not until his phonographs were displayed at the Paris Exposition of 1889, were all the skeptics converted. Since that date the sheet



TOWER OF INSULATORS



CABLE TWISTING MACHINE

machine that registers the amount of resistance which the current meets in passing through a given cable, each mile of the line being divided into units of resistance. When a break occurs in the current, the amount of resistance remaining is divided by the number of units to a mile, and thus the exact point of the damage is ascertained. In the centre of the group is a handsome model of the company's repair ship, *Mackay-Bennett*, all the cable machinery on deck being a reproduction of the actual apparatus, and illustrating the process of picking up and laying cables. Specimens of perfect cables are also shown, one of the latest pattern being intended for shallow waters, and to resist rough usage, for which purpose it is covered with short sections of heavy steel tubing, so adjusted as not to impair its flexibility.

As already stated, the majority of the electrical instruments used in surgery and dentistry, and in the treatment of various physical ailments, are to be found in the galleries. One of the most elaborate exhibits is that of a Chicago physician, whose specialty is an electric belt for which he claims wonderful cures of nervous affections. However this may be, the observer cannot fail to admire the pavilion in which he displays his apparatus. Adjacent to the Edison collection, a portion of the space is occupied by a handsomely furnished parlor, in which are valuable oil paintings. Near by is the exhibit of an electric medical supply company, consisting of stethoscopes, batteries, and appliances for electric treatment, cautery apparatus, and special contrivances used in surgery or dentistry. Among other curiosities is a small rubber

cylinder containing a galvanic battery and an inhaler, designed to relieve the sufferer from nervous and inflammatory disorders.

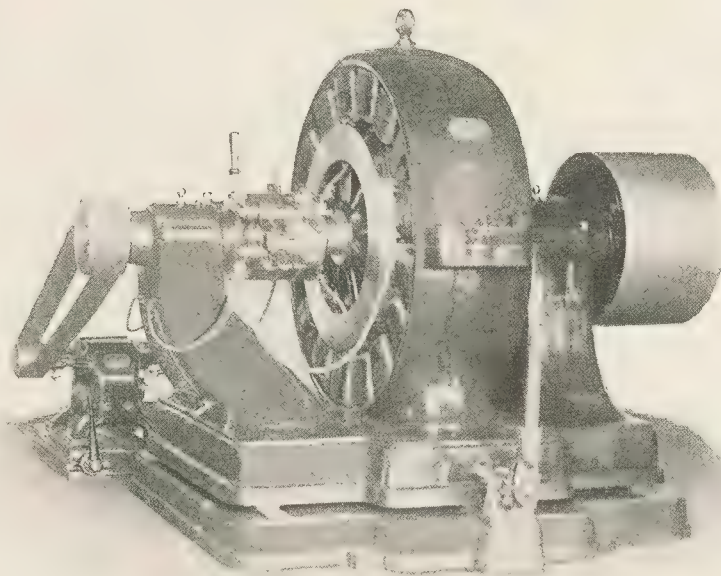
In this vicinity are several groups of electrical appliances which illustrate the investigations of scientists and manufacturers with a view to discover the best insulating agency. There are sheets and conduits, compounds displayed in bulk, and various kinds of paint which, it is claimed, will effectually shut off the electric current from all disturbing influences. One that has attracted

much attention is known as isolatine, and is exhibited by a New York house which also shows the many chemical substances used in the manufacture and operation of electrical appliances.

Elsewhere in this neighborhood may be studied the processes of gold and silver plating by electricity, and a simple yet effective machine by which any metal may be automatically engraved through the same agency.

The letters are securely clamped, and as the stylus follows their outlines an electric current is formed, and a corresponding motion imparted to the graver. Little practice is required to operate the machine with satisfactory results for the simpler kinds of work. In these western galleries are also electric doors, automatic guest calls for hotels, burglar alarms, and clocks which record the rounds of the night watchman, such as are used by the government, and in the buildings of the Exposition.

Close at hand one may study the system of an electric signal company, in a neat railway model marked "dangerous;" he may have a suit of clothes cut by an electric machine, or may seat himself in an easy chair while his



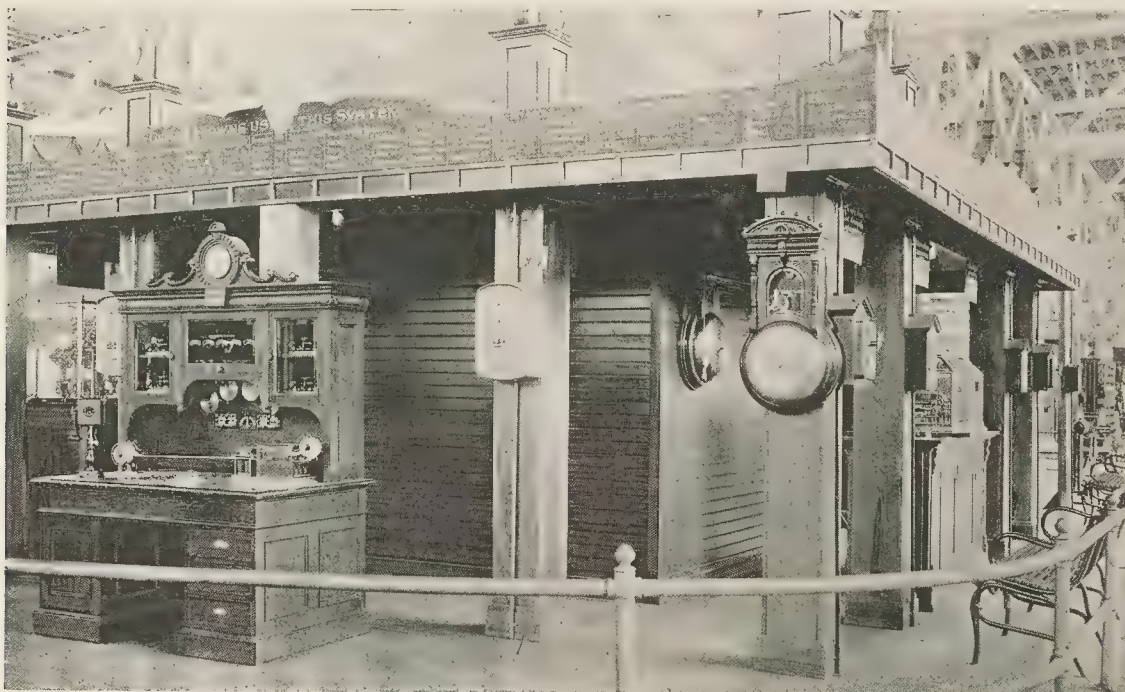
DYNAMO OF FORT WAYNE COMPANY



boots are polished by electric brushes. Here also is an electric incubator, with eggs in process of hatching. In one is a barely perceptible palpitation; another is heaving with suppressed activity; a third is partially opened, and from a fourth a pulp-like form has drawn itself partially into the world, and lays panting over its former prison walls, as if gathering strength to free itself. For hatching chickens by electricity, as compared with incubation by steam, the advantage is claimed that the needed temperature, a little over 100 degrees, can be

made absolutely uniform, while the machine requires but little attention. From the time the egg is placed in the incubator until the chicken comes from the shell is an average period of nineteen days. Two jars of Mason batteries are sufficient to furnish the heat and operate the thermostat, the latter never varying more than one half of a degree. One of the most interesting features of this exhibit was the sealing of a machine containing a dozen eggs, which remained untouched until the chicken emerged in due time, and in as lively condition as though fostered by the mother hen.

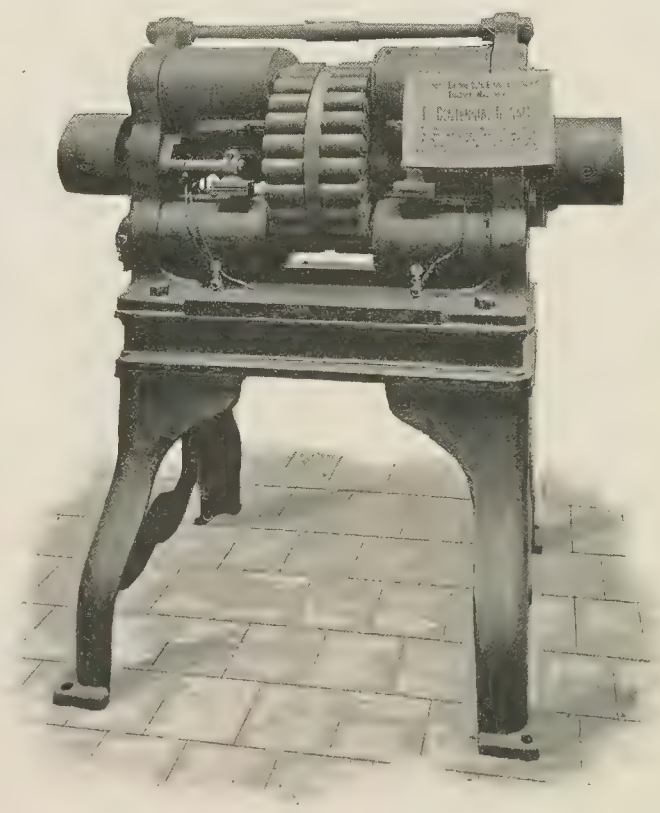
Three foreign powers have installed exhibits in the western galleries, Austria having chiefly



POLICE AND FIRE TELEGRAPH APPARATUS

a display of signal clocks and technical instruments, and Italy a small collection of china insulators contributed by a ceramic society of Milan. France has a large assortment of musical instruments, many of them overflow exhibits from the department of Liberal Arts, and having no relation to electricity. They consist of beautifully finished orchestral pieces, and include some fine specimens of inlaid work in wood and pearl, showing what may be done with pianos and other instruments in the way of cabinet decoration. There are several French inventions, some of which can be played as ordinary pianos, or by attaching them to other instruments. The music may be produced mechanically by turning a crank, or by electric self-acting machinery, and when the harmonies are combined the effect is often pleasing. More than fifty pianos are here, ranging in price from a few hundred to several thousand dollars. Of the new styles for which superiority is claimed, one has a frame of pure steel, and there is a French horn whose mouth is beaten from a solid piece of brass. In the gallery opposite this group is a row of tastefully furnished booths, the headquarters of the periodicals in the United States whose special field is electricity.

The principle that heat is generated by resistance to the electric current is illustrated in several portions of the building. Ovens and furnaces, and heating apparatus for railways, houses, factories, and public buildings, are exhibited on the ground floor, where also, as has been said, several companies show how welding may be accomplished by electricity. Other heating appliances are found in the galleries, a Wisconsin company which deals in novelties exhibiting a hair curler heated by electricity. But the most interesting application of this principle may be studied in the north gallery, where the housekeeper may see how her home can be comfortably warmed by electricity, and how her cooking may be done expeditiously and scientifically. The electric ovens are lined with wood and asbestos, which keep the heat within, and are supplied with doors of mica, and incandescent lamps and thermometers for ascertaining the temperature, and experimenting in all branches of cookery. As in other appliances, the electric current is governed by switches, the griddles, kettles, coffee pots, tea pots, flat-irons, and all other utensils having enameled bottoms in which are imbedded small copper wires. When the current is turned on and passes along the wires, the resistance offered by the enamel produces heat, which can be easily regulated and directed. For instance, in roasting beef, if one side of the piece is browning more rapidly than the other, instead of taking it out and turning it, the current is simply increased above or below as the case may require. The electric flat-irons weigh about eight



pounds, their upper portions being composed of non-conducting substances. Of all the companies which illustrate this phase of household economy, the Ansonia, of Chicago, has the most complete exhibit, presenting besides a display of cables, switches, batteries, motors, and a historical collection, including, as is claimed, the first of dynamos.

In the south gallery opposite are miscellaneous exhibits, one of which, by a Philadelphia manufacturer, is specially deserving of note. Upon an arched wall space, having a background of light blue, is a large



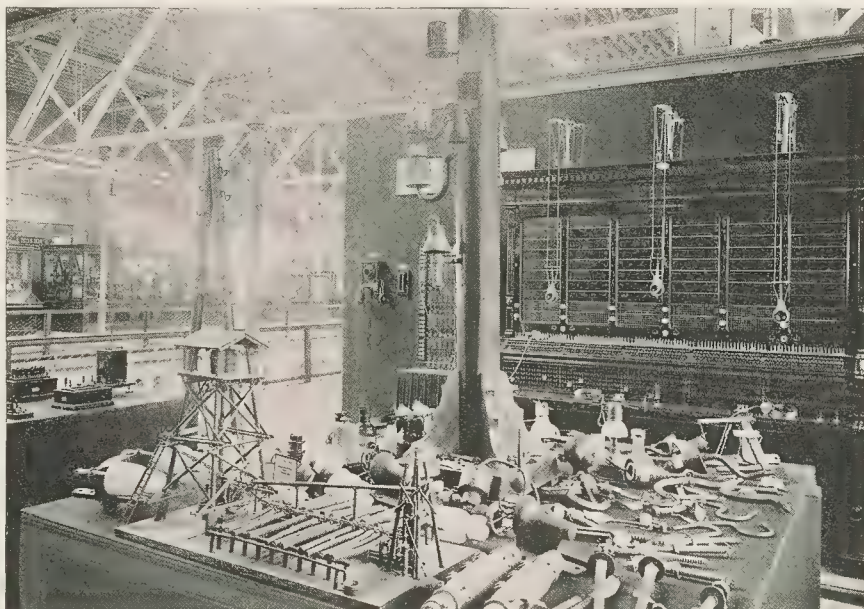
GERMAN HISTORICAL COLLECTION

eccentric, composed entirely of switches made by the company, and upon a small display board are the various patterns representing the evolution of these appliances. The first is one of a hundred made by means of a hand drill, hammer, and chisel, the later varieties, composed of porcelain and English ivory china, being of elegant workmanship, and forming a striking contrast to the others. Among the exhibits in this portion of the building may be mentioned that of a New York house, which presents many fine specimens of photo-engraving and electrotyping, the display being of plates only; also, the large pavilion adjoining containing several cases of finely wrought instruments.

In the southeastern galleries is a pavilion surrounded by great coils of cable, and masses of a carbon-like substance, the latter the crude form of an insulating material known as kerite. The exhibitors manufacture insulating tapes and cables for underground and submarine use. A New York firm builds a cabin of wire ducts or conduits, and a Cleveland company erects a pillared structure composed of carbon, with pyramids and other forms within and around it. A manufactory of the same city occupies a considerable space with specimens of its handiwork in polished aluminum, brass, and nickel, arranged upon a large sample board which forms a background to the section. The specialty is a boiler alarm, which may be either in the form of a steam whistle or an electric gong, the danger signal being given when the water reaches the highest gauge, and the float raising the valve lever which releases the mechanism.

Safety appliances for the public are seen in the many devices of the telegraph systems which have been adopted by the fire and police departments of all large cities. A New York company which has furnished complete telephone and signal systems for many large cities exhibits its apparatus around a square pavilion, on whose cornices are the names of municipalities in which they are used. Near this is a booth, from which float the national colors of Brazil, whose government manufactures its own telegraph and telephone instruments, as here represented. A large map is displayed locating the telegraph lines of the republic, and in book and pamphlet form is described the present condition of the system, and its development through native skill and ingenuity.

The exhibit of the Western Union Telegraph company is contained in a large plain pavilion, over whose main entrance are the words, "What hath God wrought," forming the first telegraphic message sent by Samuel Morse. In a case within is a photograph of this message, and the original Morse machine, side by side with the perfected instrument of 1893. Several portraits of the great inventor are hung upon the walls, with those of Cyrus W. Field, the father of the submarine telegraph system, and Thomas T. Eckert, who succeeded Norvin Green as president of the company. The pavilion also contains busts of Morse by the sculptor Greenough, and of Field, by Hartley. Several of Field's medals and other personal souvenirs are included in the collection,



GERMAN ELECTRIC APPARATUS, TELEPHONES, ETC.

together with a reproduction of the *Great Eastern*, which laid the first cable, the model being loaned by one of her commanders, with various apparatus showing the workings of the system, now some quarter of a century old. On one of the maps are indicated the locations of the Western Union lines, which include 750,000 miles of wire; and on another is a model in relief of the bed of the Atlantic ocean, in which may be traced the systems operated by the Western Union, Anglo-American, Mackay-Bennett, and other submarine companies. This is the first profile chart of the kind, and was made by Captain Dutton, formerly of the cable ship *Faraday*, of which also a model may be seen in the company's pavilion. But perhaps the most attractive exhibit is the huge, rusty grapnel, with its five prongs, which in 1866 recovered the cable lost during the previous year in nearly 2,000 fathoms of water. The cable had parted 1,100 miles from Valentia; the attempt to recover it was abandoned for a time, and a new line constructed.

With the exception of the Western Union's exhibit, and a small display of dry batteries, Germany occupies all the northeastern galleries with her well arranged collections. One large department is devoted to the exposition of optical, surgical, electro-medical, and scientific apparatus. A curious exhibit is that of artificial eyes, some of them such exact imitations of nature that when examined from different positions their pupils appear to dilate or contract. Another collection illustrates the diseases peculiar to the human eye, and its normal condition as observed in the German, Slav, Roman, Gaul, Mongolian, and Negro. In this section are some finely executed anatomical models, respiratory apparatus, a large operating table, and a complete collection of surgical instruments, the last furnished by the purveyor to the Prussian armies. More picturesque than these groups is the exhibit made by the German postal service, consisting of model post and telegraph offices, as well as reproductions of many in operation, and articles which constitute the entire working outfit of the department. There are models of telegraph towers and of imperial postal cars; telegraph instruments of the Hughes type, upon which the operators play as if upon pianos; telephones of German make, cumbersome as compared with those of American manufacture, and maps showing the distribution of telegraph lines and post-offices throughout the empire. Telephones enter largely into the telegraphic system of Germany, with some 80,000 in use. An important factor of the postal service is the pneumatic tube, and in this department is a miniature plant showing its operations. In another section are models of mail coaches, representative of early and modern times, while here is also illustrated the service of mounted messengers established along the river Spree in the fourteenth century.

The portion of the gallery which is above the eastern entrance to the building has been transformed into a court, approached by a broad stairway, the background and dais being festooned in crimson and gold, and bordered with evergreens, showing for its central object a bronze bust, mounted upon a massive pedestal, of the late Werner von Siemens, the famous German electrician and inventor. On either side are busts of Sæmmerring, announced as the inventor of the first galvanized telegraph, in 1809, and of Reis, inventor of the first telephone, in 1861. In the background also are medallions of Gauss and Weber, proclaimed as the joint inventors of the first electro-magnetic telegraph, operated in Göttingen in 1833. Fronting the busts and medallions, and arranged on the ledges of the enclosure, are the instruments, or their reproductions, designed to illustrate the historical development of the application of electricity in Germany. Here is the magnetic needle telegraph of Stöhrer, 1817, Reis' telephone apparatus, and a number of inventions by Siemens, including the dynamo of 1866, and his instruments for telegraphic printing and writing. There are also collections of ringing apparatus, electrical appliances and signals for railroads, lighting machines, samples of cables chronologically arranged, indicators, alarms, stone drills, mineral separators, and clocks, with other mechanisms showing that the Germans have won for themselves a leading rank in every department of electrical science and invention.

WORLD'S FAIR MISCELLANY.—The first general illumination of the Electricity building was on the evening of the 31st of May, and attracted many thousands of spectators. By eight o'clock the structure was one blaze of light, with myriads of incandescent lamps with revolving wheels displaying all the colors of the rainbow in ever-changing hues, and with unseen pens writing mysterious inscriptions on the walls in letters of fire. But in the very centre of the building was a huge shrouded figure which loomed ghost-like almost to a level with the rafters. Presently the chief of the department stepped forward; a moment later the shroud was withdrawn, and the Edison tower and the classic pavilion at its base stood revealed in all their cold, chaste beauty of outline. But for a few seconds only; the glare of search-lights focused upon them, causing their dark surface to shine with a dazzling radiance. Then the crystal bulb at the top burst into flame, flashing like a crown of diamonds; and finally the entire column was arrayed in robes of purple light like a pillar of fire. It was the very apotheosis of electricity, and by a thousand voices was shouted the name of him by whom these marvels had been wrought.

The illuminations of grounds and buildings begun in May, were continued throughout the term of the Fair, at first on alternate nights, and then every night in the week except Sunday nights. Occasionally the admissions after dark were larger than during the day; but as

the novelty wore off, and the average daily attendance gradually increased from 20,000 or 30,000 to 150,000, the proportion was not maintained. During one of the first illuminations, Machinery hall narrowly escaped destruction by fire. The shed that inclosed the machinery of the Westinghouse company's engines, by which at the moment power was furnished, was set ablaze through the burning out of one of the connections, caused by the pressure on the wires. Only through the promptitude and coolness of the men in charge a conflagration was averted which would have swept the building out of existence.

The light for the fountains with their prismatic hues and chameleon-like changes of color, was produced in a subterranean chamber, with which the fountains were connected. The lamps resembled the search-lights on board a man-of-war, except that for the lens used at sea was substituted a silver-lined parabolic reflector, from which the rays were shot upward for a distance of 150 feet. The lighting capacity of the lamps was controlled by a mechanism similar to clock-work, and could be intensified to a brilliancy of 350,000 candle-power. The water effects were also regulated in this mystic chamber, to the orifices of which a nozzle was attached, and through it the water projected in columns, jets, or sprays, with electric light playing upon them in varying hues from color screens beneath.

While electric light and power have been prominent factors at former expositions, they have never been so largely used and applied to so many purposes as at the Chicago Fair. At the Paris Exposition of 1879 there were some 1,500 incandescent lamps, and at the New Orleans Cotton Centennial in 1881 both arc and incandescent lamps were utilized to good effect. At the latter it was for the first time demonstrated that under this clear, white light, the delicate tints of flowers are almost as plainly visible as beneath the noon-day sun. At the Louisville Exhibition of 1883 there were 6,000 Edison lights, and at the one held in Paris in 1889, there were 1,000 arc and 9,000 incandescent lamps, both considered at the time a wonderful display of electric lighting. But in the buildings and grounds at Jackson park there were 6,000 arc and 120,000 incandescent lamps, the former each of 2,000 candle-power, while motive force of from 4,000 to 5,000 horse power was generated for purposes mentioned in the text.

In the Electrical building was installed apparatus of all descriptions excepting generators, which were located elsewhere. Power, for whatever purpose used, was furnished and transmitted, as I have said, from the station at Machinery hall, the plant being so constructed as to be complete in itself, and yet composed of numerous smaller plants.

The floor of the building was intended to sustain a minimum weight of 150 pounds to the square foot. By railroad derricks machinery of a weight not exceeding fifteen tons could be moved into position, and generating machinery up to a weight of twenty-two and a half tons could be handled by travelling cranes.

Neither for illumination nor other purposes were any of the wires placed above ground, all being fastened on insulators inclosed by subterraneous conduits. The arc lights scattered throughout the park were supported by pillars or masts twelve feet high, most of them 50 to 75 feet apart, and all arranged with a view to landscape effect.

Side by side with the Edison exhibit of incandescent lamps was a case containing many sections of fibrous vegetable growths, used by the inventor in his search for the substance best fitted for a lamp filament. The selection finally made was that of a Japanese bamboo, which is now extensively cultivated on special plantations. It is said that in arriving at this result, Edison travelled many thousands of miles, and expended at least \$200,000.

Near the pavilion of the Commercial Cable company a Fort Wayne establishment had an exhibit which overtopped all others in the galleries. It consisted of iron towers and poles such as are used in railroad construction, and for street lighting.

Nikola Tesla, the so-called wizard of physics, whose current motors are mentioned in connection with the Westinghouse company's exhibits, is one of the youngest of our great electrical scientists, and yet a man of world-wide repute. His fame rests mainly on his multiphase alternating motors, whereby are produced high potential currents of remarkable frequency. On the 25th of August he lectured in the assembly room of Agricultural hall before an audience consisting largely of electrical engineers and scientists. During his discourse he exhibited a motor or oscillator driven by compressed air, which made 80 vibrations to the second, stating that he had made others capable of several thousand vibrations to the second. To this he attached a dynamo small enough to be slipped into the pocket, and yet of considerable power.

Elsewhere is noticed the exhibit by the seismological laboratory of the Imperial university of Japan. As stated, the first instrument to record motions of the earth was invented by a Japanese more than seventeen and a half centuries ago, but it was not until 1875 that an observatory was built for the purpose in Tokio. The first instrument used was the one invented by Palmieri, the director of the observatory on Mount Vesuvius; but since 1884 this has been replaced by the Milne instrument, which records horizontal and vertical motions, with the time and duration of shocks. This year also marks the commencement of a system of investigation covering the entire empire, the observatory publishing guides for noting and reporting seismic phenomena, with or without the aid of instruments. These were distributed among hundreds of officials and others whose reports were transmitted free by the postoffice. From these maps have been made showing the disturbed areas of the 3,800 earthquakes which have occurred throughout the empire from 1885 to 1890, as well as their relative intensity. Observations since that year have greatly added to previous records, especially those of the great earthquake of October 28, 1891. In this the centre of disturbance was almost in the middle of the main island, though with shocks more or less severe almost throughout the empire. Within a comparatively small radius over 7,000 people were killed, and 142,000 houses totally destroyed. The ground was rent and cracked, permanently depressed or upheaved, thousands of landslips were produced, water and sand were ejected, multitudes of embankments shattered, railway lines twisted, and bridges hurled into rivers, which, with other havoc, was graphically depicted in the Japanese section of the Electricity building.

The enormous switchboard exhibited by the Brush Electric company was sold through its agents in Yokohama for the use of a power station now being erected in Manila, Philippine Islands, the company also furnishing several dynamos.





EAST ENTRANCE HORTICULTURAL BUILDING



CHAPTER THE FIFTEENTH

HORTICULTURE AND FORESTRY



TO him who reads aright the lessons of the Fair, one of the most significant is that the nations of the world are coming nearer together than ever before, and among its highest aims is to hasten this process of unification. Through the activities of man, even the vegetable kingdom is becoming, as it were, a universal brotherhood, and intelligently viewed, the Horticultural department not only affords an opportunity for comparing the products and methods of foreign lands with those of the United States, but offers a panoramic view of the entire vegetable world, its scenes of course shifting with the changing seasons, and though here described in the present tense, displaying innumerable phases such as neither pen nor picture can delineate.

Under the general term horticulture are included, for the purposes of the Exposition, viticulture, pomology, and floriculture, wines, fruits, and flowers being displayed in all stages of development. By means of photographs, books, and appliances are illustrated the modern management of vineyards, and methods of manufacture, bottling, packing, and shipping. In the pomological sections are fresh, dried, preserved, and canned fruits. In a miscellaneous department are nuts, jellies, vinegars, ciders, etc. Here also are mills and presses, and the latest inventions for drying and preserving fruit. Floriculture appears, decked in robes of beauty, gigantic palms and tropical plants forming a background to delicate ferns and flowers. Another subdivision consists of floral designs and flower stands, with ornamental plants and grasses, and literature relating to their growth and training. Vegetables and seeds, with all the best appliances for ornamental and landscape gardening, are also grouped under the general heading of horticulture.

Fronting 1,000 feet on the lagoon, and with an extreme width of 250 feet, the Horticultural building covers an area of five and three-quarter acres, and with its greenhouses, and other adjuncts, of eleven acres. But as to the size of this structure, and of the other principal structures of the Fair a better idea may be conveyed by stating that the former, though one of the smallest of the group, is almost as large as the Crystal Palace, in which has been partially preserved the home of the London Exhibition of





HORTICULTURAL BUILDING, FROM WOODED ISLAND.

1851, and that it contains some 90,000 feet more of exhibiting space than all the three edifices used for similar purposes at the Philadelphia, New Orleans, and the last of the Paris expositions.

While intended mainly as a spacious conservatory, in structural design the Horticultural hall by no means suffers from comparison with its more ambitious neighbors. In a word its plan may be stated as including a central pavilion, more than 200 feet square, surmounted by a crystal dome, and connected with smaller pavilions at either end by two longitudinal series of galleries, glass roofed, from 50 to 70 feet in width, and inclosing garden courts, each somewhat more than half an acre in extent. A feature of the edifice is its decoration in alto and basso relievo, the frieze



MAIN ENTRANCE



1 AUSTRALIAN TREE FERN, 27 FEET HIGH
2 STAG HORN FERN

3 AUSTRALIAN PLANTS

4 CACTUS FROM U. S. BOTANICAL GARDENS, WASHINGTON, D. C.
5 SOUTH SEA ISLAND TREE FERN



EXIT FROM CRYSTAL CAVE

plant life and floral decoration, presents one of the most striking kaleidoscopic vistas contained in this city of wonderland. Rising nearly to the summit of the dome is a miniature mountain, gigantic ferns, and palms, creepers, and flowers of brilliant hue, giving to the scene a rich tropical aspect. Above are great hanging baskets, and at the base, around a border of green fringed with blossoms, the sago palm, Abyssinian banana, screw pine, and other striking forms of tropical vegetation. From the gallery also may be seen to excellent advantage the gigantic forest growths of Australia towering roofward like the pillars of a temple, and in a conservatory opposite the softer floral beauties of the United States.

If less picturesque, the central galleries furnish exhibits no less entertaining than those on the ground floor. Among them is a large collection of views of the botanic gardens in Sydney, New South Wales, which have sent so many of their treasures to the Fair. The gardens of the Imperial university at Tokio are also well represented by photographs, and another interesting feature is the artificial fruits of the Yokohama Gardeners' association. Photographs of famous gardens and nurseries in the United States, diagrams of public parks in Colorado, Oregon, and elsewhere, with the models of villa gardens which line other sections of the wall, indicate that a principal object of this gallery exhibit is to illustrate the latest methods of landscape gardening. Then there are richly stocked herbaria, especially from the western states, and thousands of pressed plants and flowers tastefully displayed in revolving frames. One of the most remarkable collections was made by a woman of Colorado, who for

which is six feet in height, and extends along three of its sides, displaying the handiwork of a cunning artificer.

As to interior effect the arrangement of the building is admirable, and if exception has been taken to the depression of the dome, whose height of 115 feet is barely two-thirds of its diameter, it will be observed that the long, low façades of the conservatory forbid such towering aspirations as are not inappropriate to the more substantial structures of the Exposition. Moreover this seeming disproportion is relieved by the curved glass roofs of the galleries on either side, by the lower domes at its base, and by the crown with which it is surmounted.

By the architects, Jenney and Mundie of Chicago, was adopted in their decorative plan the style of the Venetian renaissance, while the walls of the front galleries and those which surround the side pavilions are divided by pilasters of the Ionic order into windowed bays, thus reducing the wall surface to the smallest possible area. At the principal entrance, from the terrace fronting on the lagoon, is a triumphal arch, the vestibule of which is profusely decorated with statuary, and on either side of the main pavilion are groups of sculpture fashioned by Lorado Taft, one representing the awakening of the flowers, and the other their repose at spring and autumn tide. These are among the most chaste and expressive of all the artistic embellishments of the Exposition buildings, and standing forth in bold relief under the vault of the central dome, form the complement of the architectural design.

From the promenade gallery encircling the dome, the hall itself, with its wealth of



WEST SECTION OF FERN MOUNTAIN



LOOKING INTO THE VITICULTURAL HALL

months climbed its lofty ranges, and travelled over foothills and plains, contributing in no less than a thousand varieties an almost complete display of its flora. The mouse-fungus, with rust, blight, mildew, rot, and all the pests and plagues of the vegetable kingdom are here exemplified, and there are odd conceits for fences, rustic vases, and other garden ornaments, with collections of dried grasses, and preserved flowers made into wreaths, baskets, and other designs.

Descending to the base of the miniature mountain the visitor finds in this neighborhood, almost side by side with tropical exhibits, special displays from New York, New Jersey, and Pennsylvania, the leading floricultural states. Palms from Australia and the Americas lift their graceful fronds, and here are represented the choicest treasures from the conservatories of millionaires, such men as the late Jay Gould, A. J. Drexel, George W. Child, and Erastus Corning. Here also an Indiana century plant first displayed its yellow flowers, with others of its kind on exposition, all under the great dome, and in the adjoining conservatory, while France shows the rich masses of rhododendrons in which she takes a national pride.

A broad avenue passes around the miniature mountain, and along its outer edge New York and Pennsylvania again present their floral displays. In one corner is an elegant booth in which are plants, hanging baskets, cut flowers, and floral ornaments and designs—a contribution from the empire state. A few steps further is a collection of New Jersey snap-dragons, and other insect devouring plants. In this locality is also a collection of plants from



UNDER THE DOME



FLORAL DEVICE IN ROTUNDA



HORTICULTURAL BUILDING, FROM SOUTHEAST CORNER



the stalactites and crystals which form the cathedral chimes, the bridal chamber, and other well known features, all represented with remarkable accuracy.

Entering the southern conservatory from the rotunda, we find ourselves in the midst of a profuse display of orchids and ferns, presented mainly by the New Jersey firm of Pitcher and Manda, whose exhibits are a prominent feature in the floricultural department. The orchid groups, which include private collections from Albany, Philadelphia, Jersey City, and other localities, are in truth one of the leading attractions of Horticultural hall, but as a considerable proportion of the 4,000 or 5,000 existing species, with all their varied forms, their brilliant hues, and delicate odors, is here on exposition, a detailed description would be obviously out of place.

Further to the south the women of Texas have their exhibit, those of Galveston contributing Cape jasmines and sweet bay trees, while Laredo sends a large bed of cacti, both of which attract many visitors to this section. Missouri's display adjoins a grove of palms near the centre of the conservatory, and includes many rare and beautiful plants from the botanic gardens of St Louis. Here also Pennsylvania has another large exhibit; Massachusetts occupies a limited space, and other states have scattering contributions. In the Illinois display are fine specimens of the bay laurel, and Indiana has a flourishing group of begonias. In this conservatory of the states is also a bed of cacti representing the botanic gardens at the national capital.

Corresponding to these exhibits south of the central court, is one in the northern section showing the floricultural collections of foreign lands. In the centre are the huge tree ferns from Australia, some of them forty feet high, with other plants of that species whose leaves are in many fanciful shapes. Here also are the staghorn ferns, from seven to eight feet in diameter, and as many in height, clinging to trunks of teak-wood trees, whose vitality has been exhausted in their embrace. At their feet are more delicate ferns with mosses, grasses, and many of the creepers which grow in

the executive mansion, at Washington, the most striking of which is the so-called crown of thorns.

Forming a portion of the New York display is a large model of the national capitol, constructed of Canadian thistles, and near this are several large beds of Pennsylvania cacti, one of them alone containing three hundred varieties. Stepping into a small chamber in the form of a cave beneath the mountain, we find here a miniature reproduction of the famous Black Hills cave in South Dakota, with



EXHIBIT FROM THE NATIONAL CAPITOL

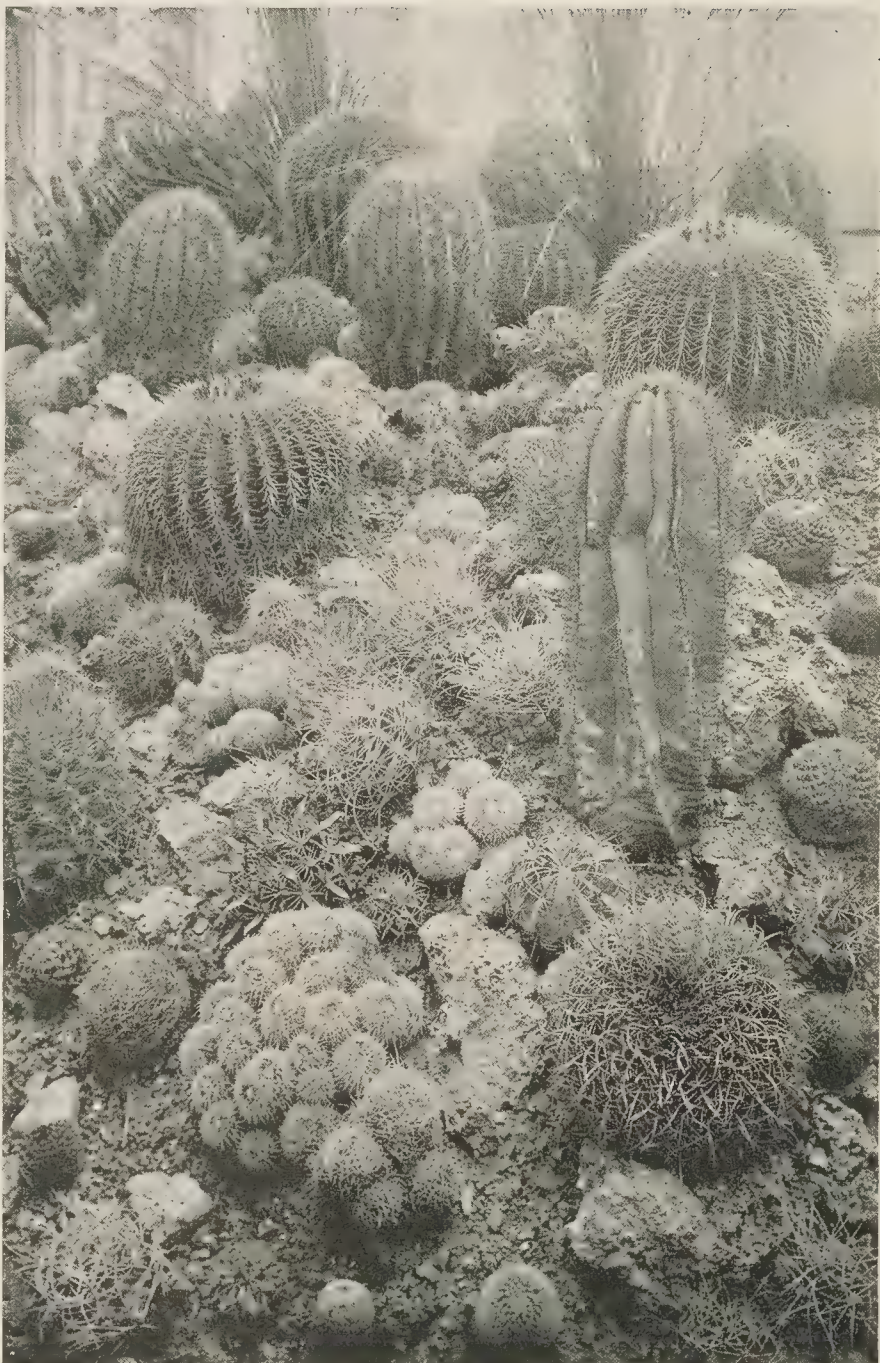
profusion amid Australian forests. In the Canadian exhibit adjacent, Ontario has many varieties of palms and ferns, eighty in number, and most of them from the horticultural gardens at Toronto. Among the former, one of the most remarkable is known as the Sabal Anderson description. Of other trees and plants, including cacti, flowering shrubs, and ornamental leaf plants, there is also a large collection.

Further toward the north is the Japanese garden, arranged in the simple, artistic fashion for which that people is famous. A rustic bridge spans a small pond, filled with gold fish, and fringed with water lilies and ornamental plants. Near by are the quaintest of urns and vases, containing orchids and other floral treasures, with plants of all kinds, miniature hills, among which are clusters of sago palms and models of animal life, with a rough stone wall covered with native evergreens, morning glories, and creepers, and with colored sands arranged in geometrical figures, all forming a picture in which is substantially reproduced a portion of the Japanese imperial garden.

On the opposite side of the conservatory are beds of cacti from Mexico, arranged as single specimens or in conglomerate masses, and ranging in size from that of an apple to a bushel basket. Some appear like petrified porcupines, or spiny creatures of the deep; others are thin and starved, and still others seem as if they had lived upon the fat of the land.



ONTARIO PALMS



BED OF TEXAS CACTI

This exhibit, as well as the other cactus beds scattered throughout the department, is specially typical of America. One of the most prolific of the forty or fifty species is the elephant tooth cactus, bearing a flower like a rose or lilac, red or crimson fruit succeeding the blossom. The fig cactus is similar in shape to the fruit from which it is named, its pale yellow flowers giving place to an edible product resembling the gooseberry, which serves as food for the cochineal insect, and at times for the inhabitants of Mexico and Central America.

Beyond the cacti bloom the cannas and begonias of Great Britain, and the azaleas of Belgium, and Germany. Especially noticeable is the German display, neatly and artistically grouped around a central fountain. At the upper end of the conservatory, beyond the banners of Australia, and the white and red flags of Japan, are the tropical plants of Trinidad, and above her exhibit rests, on a large pedestal, the golden lion of Britain.

Between the main hall, the pavilions, and their connecting curtains, are two spacious courts, the one to the south occupied by large basins or tanks filled with aquatic plants. In the northern court is a vault-like pavilion, 189 by 135 feet, constructed of iron, and stocked with South German wines. The façade and roof are adorned with appropriate statuary, and the walls

are covered with paintings illustrating various scenes in the wine producing districts of the German empire. The vine-clad banks of the Rhine and the Necker, the famous district of Moselle, the wine industries of Baden and Alsace-Lorraine, are all depicted in graphic art, while plaster casts and a sparkling array of wines in bottles complete this display from the fatherland. The historic monument of Germania and the Rhenish castle of Ehrenfels are reproduced, as models, in the entrance hall of this structure. The exhibits of wine are arranged according to locality, each specimen being labelled, and grouped with reference to the vineyard, village, or district where it was produced.

Apart from this the collection of wines is in the southern extremity of Horticultural hall, where Spain, France, and Germany, California, Australia, and other countries vie with each other in the quality and artistic grouping of their exhibits. Spanish ports and sherries, fashioned into pyramids, are displayed in a gaudy pavilion, or series of arched, open structures. Sometimes the towers are formed of solid bottles; again the base is made of casks and barrels, with rows of bottles let into their sides. Within these glistening piles are real sherry wines from the Xerez district, the strong, dark vintages of Valencia, and lighter, sweeter grades from the Spanish sierras, from whose vineyards also come the grapes which are made into Malaga raisins.

A large portion of the French collection consists of sparkling champagnes, including a tastefully arranged exhibit from Rheims, its ancient home, and, with Epernay, still its most important centre. An immense bottle reaching nearly to the ceiling of the hall may be considered as a monument to the Benedictine monk, who, two centuries ago, gathered the wines from the districts surrounding Rheims, and by mixing them made the first champagne that history records. The white wines of the Sauterne and Gironde districts, the rosy Medocs, clarets, and Burgundies, and a dozen other brands appear in various devices, as contributions from exhibitors in Bordeaux, Marseilles, Paris, and Nancy. Cordials and mineral waters are also in plentiful supply, and models of machinery, as well as of vineyards in the famous districts of Medoc and Gironde, serve to break the monotony of endless rows of bottles. In photographs and charts are shown all the insects which injure the vine, and their mode of attacking it, the king of them all, the phylloxera, receiving the lion's share of attention.

The German display in the southern section of the hall is a large and massive exhibit, of more general character than the one already mentioned. Worthy of note are the sweet, mellow wines of Rhenish Bavaria, the red wines of the Ahr, and the stronger products of vineyards planted on the banks of the Rhine; but most of the principal wine-producing districts of the empire, with their output of nearly 100,000,000 gallons a year, are here represented. In this collection also is a large assortment of beers and brandies, of cider, temperance, and



AUSTRALIAN TREE FERNS



FROM THE GOULD CONSERVATORY, HORTICULTURAL HALL



MEXICAN EXHIBIT OF CACTI

all other beverages that find favor in the fatherland.

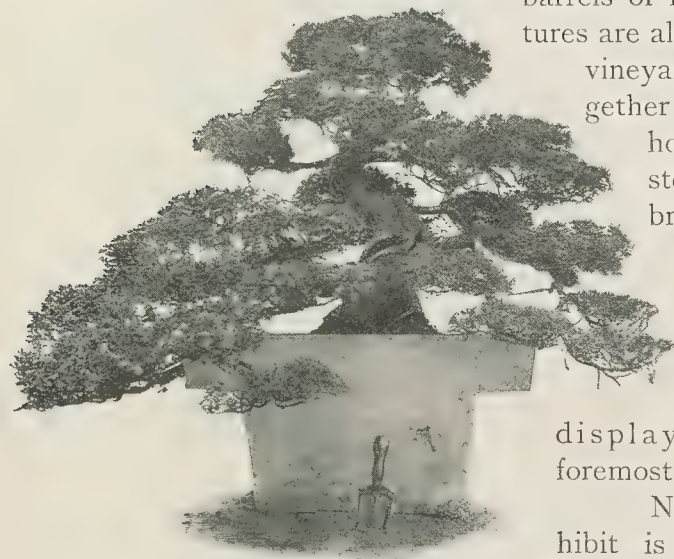
Adjacent to this, and in the southwestern corner of the viticultural pavilion, is the display of California wines, by far the largest and most attractive of our domestic collections, its effect increased by the skilful grouping of the exhibits and the ingenious structure which contains them. A red cedar pavilion, 40 feet in height, is fashioned so as to resemble one of her giant trees, the main entrance having the appearance of an archway built of rocks, while around the trunk are various figures emblematic of viticulture. The goddess of the vine is crowned with a tiara of vines and grapes, and toward her an Indian girl is approaching with fruit-laden basket. A padre, with spade in hand, represents an early stage of the industry, and a huge grizzly bear is a character in Californian history which requires no introduction. From the gallery a staircase leads into the pavilion, so that the visitor may pass either from the ground or upper floor to the exhibits within.

Passing through the main doorway, we pause for a moment before a large panoramic view of the Golden Gate and the harbor of which it is the portal. Then turning to the exhibits, we notice first of all the collective display of several of the largest vintners and viticulturists, whose cellars in San Francisco and elsewhere contain larger stores of wine than those which Hannibal wasted, when, on his march toward Rome, he bathed his horses' feet in the choicest vintages of Italy. Of some of the vineyards, covering their thousands of acres, there are paintings by local artists, with tablets and appropriate mottoes. A favorite corner of the viticultural hall is in the shape of a redwood tank, garlanded with vines, and forming, with its contents, the exhibit of several large pro-

ducers of Sonoma county, prominent among whom is an Italian-Swiss colony. In a separate structure are also represented the great vineyards and cellars of the late Leland Stanford, at Vina, in the Sacramento valley, its court opening through an arched entrance way into a spacious vault, lined on either side with barrels of huge proportions. In pictures are also reproduced these famous

vineyards and wine cellars, together with the bonded warehouse in which at times is stored \$1,000,000 worth of brandy. From Napa, Sonoma, Santa Clara, Alameda, and other counties there are smaller exhibits, all contributing of their best toward a combined display representing one of the foremost of Californian industries.

Not the least valuable exhibit is that of the State Viticultural commission, consisting of



JAPANESE DWARF CEDAR



JAPANESE EXHIBIT



GERMAN FLORICULTURAL DISPLAY

of California have assumed any large proportions, or indeed that here were known either the art of producing marketable wines or the grapes best adapted to the purpose. As late as 1860 the bulk of her wines was made of mission grapes, such as the Franciscan fathers transplanted from Mexico, and from which was extracted a light colored beverage, heavy, and rank of flavor. Later, many foreign varieties were introduced, largely through the efforts of the commission; and presently wine-making was based on scientific methods, and became a fairly profitable industry. Then came over-production, for as yet the demand was only for local consumption; but gradually California wines gained a foothold in eastern and European countries, especially in France, where they are doctored and often returned in adulterated forms, to be sold under foreign labels at from three to five-fold their original cost. In 1881 more than 3,000,000 gallons were shipped to the Atlantic states; in 1890 more than 12,000,000 gallons were forwarded by rail or sea, and of the present output, averaging some 20,000,000 gallons a year of wine, and 1,500,000 of brandy, or more than one-half the entire yield of the United States, at least 70 per cent is shipped to eastern and foreign markets.



ELEPHANT EARS LILIES

Aside from California, the most elaborate of domestic collections are from New York, Ohio, and Missouri. The dry wines, champagnes, and brandies of the empire state are especially noticeable; exhibitors from Ohio and the region bordering on Lake Erie group their specimens in and around an elaborate column of bottles, and two of the most prominent wine companies of Missouri show their samples in neat and tasteful pavilions. New Jersey is also well represented, and among her participants is one of the oldest of German wine makers in the United States. From Manassas, Virginia, comes a specimen of her vintages, and there is wine from a vineyard planted on the battle-field of Bull Run.

Near the French section are towers and pyramids of bottles filled with the red and white wines of New South Wales. Photographs of her vineyards show that they are large and thrifty; and here also the information is conveyed that among the more important of native red wines are Burgundy, claret, and hermitage; of sweet wines, Muscat, port, and sherry; of white wines, hock, Madeira-dry, Shiraz, and Tokay. Australian vintages, it may here be observed, are gradually finding favor in European markets, with exports to England alone of 200,000 or 300,000 gallons a year. Already the tentative stage has been passed, and many varieties will bear comparison with the lighter wines of French production, while for domestic use they have almost superseded imported.

Across the aisle from the exhibit of New South Wales are the light wines of Austria-Hungary; and here also Russia displays the products of her Caspian and Caucasian vineyards. In a far corner of the hall are

practical and reliable descriptions of viticulture as pursued in California. On either side of its space are growing vines, above which are photographs of grape clusters, showing the best varieties for the production of wines, brandies, and raisins. Famous vineyards are also depicted, and in a colored series of state and county maps are shown the areas planted in many varieties of grapes.

From a few hundred acres of vineyard planted by the padres and their neophytes during the pastoral days of California, the area under cultivation increased to nearly 200,000 acres in 1892, with more than 150,000,000 vines, yielding, in full maturity, an average of three or four tons to the acre, a ton of grapes producing about 120 gallons of wine. It is not until recent years that the viticultural interests

the wines of New Mexico, North Carolina, and Japan, in small but tasteful groups. On the pavilion of North Carolina is an inscription which claims that her territory is the home of the grape; thus recalling the stories told by the discoverers of the Atlantic coast as to the profusion of wild grapes along Carolina shores. The Japanese booth has corner posts of bamboo poles, and above it is the national flag, whose device is a red ball upon a white background. The names upon the bottles are strange, and we wonder, for instance, what such a wine as selijyunbudosyu can be, hoping that the beverage is more palatable than its name suggests.



INTERIOR OF THE GERMAN WINE CELLAR

consisting mainly of ornamental structures, composed of casks and bottles, the centre-piece resembling a large flowering bush. Near the base of the structures are many large diplomas presented to Italian wine-makers at former expositions. Of the wines themselves the choicest are those from vineyards planted on the seaward slopes of Mount Vesuvius. The wines and brandies of Greece are displayed in a white pavilion, the roof of which is supported by Corinthian pillars, and at the further end of this gallery are exhibits of California raisins, one in the form of a pyramid of glass cases from Escondido, and others neatly arranged by Fresno dealers and packers.



PART OF GERMAN WINE EXHIBIT

The pomological exhibits are mainly grouped along the curtains of Horticultural hall, and largely consist of the green products of the United States, and other lands. Shipping their fruits in compartments cooled by refrigeration, such distant regions as the Cape and Australian colonies forwarded their more hardy species in fresh condition, while grapes and orchard fruits of the season of 1892 were preserved in cold storage for exhibition, not only in our own but in foreign countries. Thus France has sent us several hundred varieties of deciduous fruits, her display of pears being the largest, and one of the best on exposition. Russia has forwarded a collection gathered from every region of the empire, even from the frozen plains of Siberia,

while from the tropics came varieties that could not elsewhere be seen. From northern Africa came a consignment, and New South Wales installed

In the gallery of the viticultural section are the government exhibits of Italy, Greece, and Portugal, with miscellaneous assortments from France and Spain. The latter include the cordials of a Spanish manufacturer, of which, it is said, the Infanta loves to partake. On the opposite side of the gallery is the Portuguese collection, contained in a pavilion of which one of the arches spans the stairway leading to the upper floor. Vines are trellised over the wood-work, and the national flag and royal coat of arms are grouped over the principal arch. Within are said to be the genuine wines of the Oporto district. Italy occupies the western end of the viticultural gallery, her exhibit



IN THE FRENCH SECTION

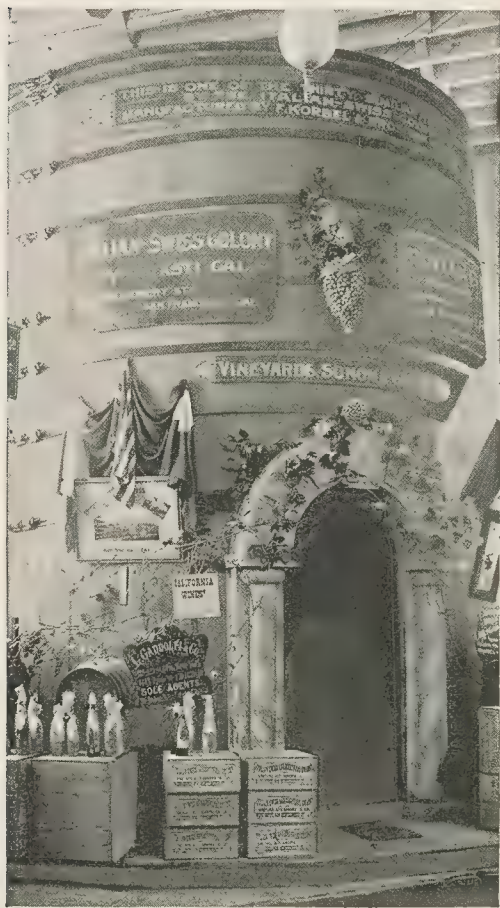
the first shipment of fresh fruit sent from Australia to the United States.

About the middle of March several barrels of apples, a bushel of pears, and a crate of grapes were placed on board a sailing vessel bound from Melbourne to San Francisco, and then forwarded by rail to Chicago, where they were installed in good condition. Other shipments of fruit were made from Australia under more favorable conditions; and by Atlantic steamers, with their cold-storage compartments, oranges, lemons, figs, and other fruits were brought from Naples and elsewhere in southern Europe. Thus the pomological department at Jackson park represents the conditions and products of the principal fruit-growing regions of the world. Several countries which could not furnish a complete exhibit substituted wax and plaster models, Germany excelling all others in this respect, with imitations so perfect that it is almost impossible to detect them. In drawings and paintings are also placed before the visitor the native fruits of several lands.

A liberal but divided space in the northwestern section of the hall is devoted to the citrus display of California, one that is in all respects worthy of the golden state, collected and grouped with the utmost care, and renewed as

occasion requires, the waste of fruit from decay and damage amounting, in this and other exhibits, to hundreds of pounds a day. On tables, in piles, in pyramids, and in more complex forms, one of them reproducing the orthodox liberty bell, are oranges and lemons of all varieties, gathered from many portions of the state, from San Diego county, adjoining the Mexican border, almost to the boundary line of Oregon. Among the scores of specimens are the best that Riverside and other citrus belts could send, including Washington and other navels, Mediterranean sweets, St Michaels, and Malta bloods; while of lemons there are the Sicilian, Lisbon, Bonnie Brae, and Eureka.

At the opposite end of the section the citrus belt of southern California is represented by a tower of oranges, thirty feet high, its base of navels and other of the larger species, above which are the smaller varieties, its top surmounted by an eagle, and encircled with rows



REDWOOD TANK

of lemons fashioned in the shape of a cornice. In the open court beyond are orange and lemon groves in miniature, with other exhibits illustrating California methods and products by practical results. Add to this the peaches, nectarines, and apricots; the cherries, and plums; the apples, pears, quinces, grapes, figs, olives, and berries which California had to show during the season of their fruitage, and no wonder that the display from the golden state was to the majority of exposition sight-seers almost in the nature of a revelation.

Fruit-growing, as I have said, is every year assuming larger proportions in southern and central California, where, from the foothills of the sierra to the shores of the ocean, there are large areas adapted to this industry. Many thousands of acres, before devoted



WINE EXHIBIT, CALIFORNIA



CALIFORNIA'S TREE PAVILION



WINES OF ITALY



WINES OF PORTUGAL

tons of fruit, in whatever form, were forwarded to eastern points; in 1880 the total did not exceed 3,000 tons; for 1890 shipments of fresh fruit amounted to 52,500 tons, and of dried fruit, 33,000 tons. For the three years ending with 1889 the trade with New York alone increased in more than ten-fold ratio; in Chicago almost as much, and in either city California fruits were hawked around their streets, and were for sale at moderate prices in hundreds of stores and booths. Said the New York *Sun*: "The products of Pacific slope orchards and vineyards are now competing with our own fruit products, and beating them out of their boots, so to speak, in spite of the 3,000 miles of disadvantage under which Californians labor in comparison with local growers."

Between the two divisions of the Californian exhibits are scores of long tables covered with groups of apples, including the russet, Ben Davis, Northern Spy, and their kindred, from all the states. New York and Michigan occupy the central spaces, flanked by Wisconsin and New Jersey. "York state" apples have ever been favorites, even with western people, and assuredly her 110 varieties displayed in Horticultural hall will not dispel the charm, especially her Newton pippins and Hudson river apples. Of excellent quality also are her grapes, pears, strawberries, and other fruits, smaller than western descriptions, but, as is claimed, superior as to flavor, texture, and durability, the rich western soil favoring rapid growth and bulk at the expense of finer qualities. Minnesota and Illinois are grouped beyond New York, the latter occupying a tasteful pavilion, divided into sections, in which are displayed her berries arranged according to locality. Iowa also maintains her reputation as a fruit-growing region. Tokay and other grapes, and the large orange cling peaches of the western states, are also on exposition, some of the latter almost as large as summer squashes, preserved in liquids, and displayed in glass jars.

to cereals, are being planted as orchards and vineyards, while in quality, as in quantity, the yield is steadily improving, for inferior fruits are almost unsalable, either in local or other markets. It was not until 1869 that eastward shipments by rail became possible; but since that year, notwithstanding almost prohibitive rates of transportation, the volume of production has increased from thirty to fifty-fold, and with the promise of still more remarkable development, awaiting only the advent of competing railroads. In 1870 less than 1,000



LOOKING INTO THE VITICULTURAL HALL

The strongest feature in Missouri's exhibit was her choice collections of peaches, berries, and apples, the famous olden fruit farm of Howell county, and other orchards of the Ozark mountain country sending frequent consignments of peaches in season, while, earlier during the term of the Fair, southern Missouri sent strawberries of wonderful size and flavor. In her exhibition of fresh fruits, replenished and varied throughout the season, Missouri was a competitor with such states as Delaware, New York, New Jersey, Pennsylvania, Ohio, Michigan, Illinois, Wisconsin, Minnesota, and Iowa. There were also 1,000 glass jars of all sizes and shapes, filled with nearly all the fruits, berries, and vegetables of the temperate zone, preserved in antiseptic fluids, so that for several years some of them have almost retained their natural appearance. Arkansas shows many



LIBERTY BELL IN CALIFORNIA SECTION

specimens of apples, pears, peaches, plums, and small fruits, all of excellent quality, and especially her apples, whose flavor and staying qualities are strongly commended.

A theme of almost universal comment are the exhibits of the far western states, apart from that of California. From Colorado come berries as bright and fresh as her own mountain air, with fruits preserved in alcohol, and wax models, taken in fac-simile during the autumn of 1892, of more than 600 specimens of apples, peaches, pears, quinces, and melons. Idaho sends her preserved grapes, prunes, egg-plant, radishes, and other fruits and vegetables, some of which were raised at an elevation of six thousand feet above sea level. Oregon, Washington and Montana have thousands of green and preserved specimens of apples, apricots, cherries, peaches, pears, plums, prunes, grapes, and berries. The Oregon and Washington booths were somewhat of a surprise; for even among the more intelligent class of visitors, many were not aware that either state could send anything more than samples of their farm products, fish, and lumber. Certain it is that few expected to see here such clusters of Black Hamburg grapes as Oregon sent, some of the bunches weighing nearly a dozen pounds. Her orchard fruits are also of choicest quality, and especially her apples, which, for thirty years or more, have been largely raised for export.

Adjacent to the Oregon pavilion is the Florida section, where he who is so disposed may compare the fruits of the furthest south with those of the far northwest. At the entrance is an archway of russet oranges,

and near by a tall cocoa-nut tree raises its head almost to the ceiling, around its trunk an assortment of nuts, with portions of the shell removed. The walls are lined with gigantic palm fronds, beneath which are rows of cocoa-nuts and pine-apple plants, the latter in all stages of growth and bearing. By Florida were sent the first peaches to the Exposition, with a small collection of early tomatoes, cucumbers, and other fruits and vegetables out of season in the north and west, all the result of private enterprise, for there was no state appropriation for any purpose.

The artificial fruits of Germany are wonderful specimens of artistic manipulation. Crisp lettuces, large apples, somewhat speckled, juicy pears, plums, and berries, parsnips and turnips—cut through here and there to show the interior structure—and other fruits and vegetables are spread before the visitor in such perfect imitation that the closest inspection almost fails to detect them.

Near the California orange tower is a collection of Italian fruits, mainly shipped from Palermo, and opposite is a small display of apples and pears from New South Wales. When their history is known, certain red and yellow apples from the Australian colony attract much attention; for the latter have travelled hither via the Pacific ocean and San Francisco, and the former by way of the Suez canal, the Mediterranean, London, and New York. Both were shipped from the same orchard near Sydney, and those which crossed the Pacific arrived at the Fair two weeks earlier than the consignment forwarded by the Isthmus route.

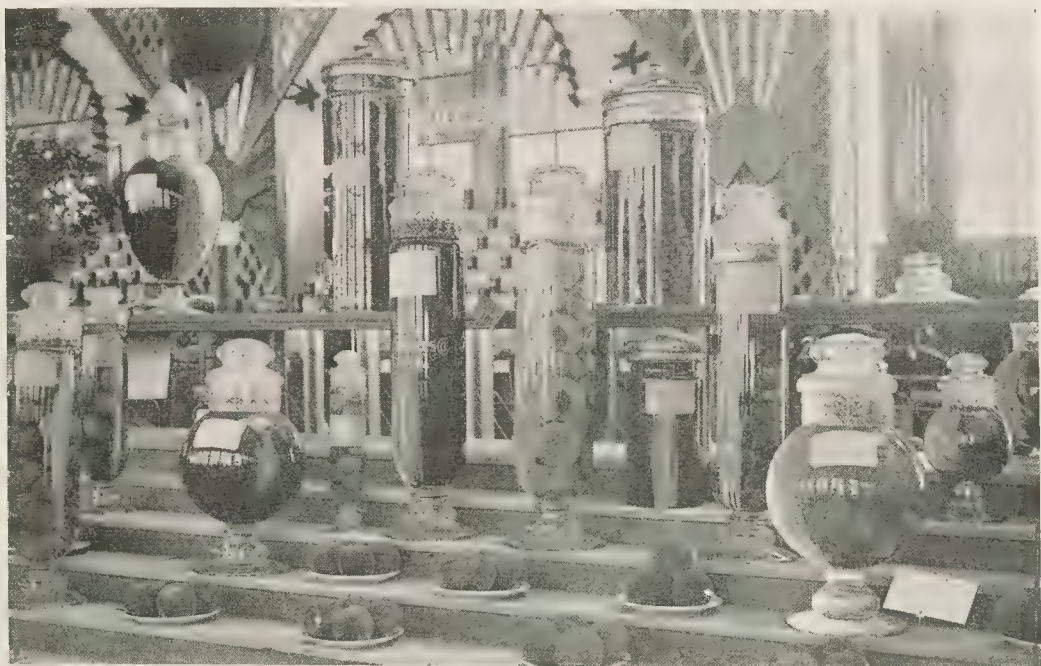
North of the main western portal is the Canadian exhibit, her specimens of berries and other fruits, fresh and preserved, arranged in four pavilions, and on triple rows of tables, the province of Ontario making the largest display. While preserved fruits form the bulk of the collection, the apples, peaches, and berries grown in the garden region enclosed by the great lakes are as fresh as though shipped from Michigan or Wisconsin. Quebec has also a moderate exhibit, and Nova Scotia and Prince Edward's Island prove their capability for producing the finest of fruits. Among the apples from British Columbia are some choice specimens from the orchards of Lord Aberdeen, now governor-general of Canada.



CALIFORNIA CITRUS TOWER



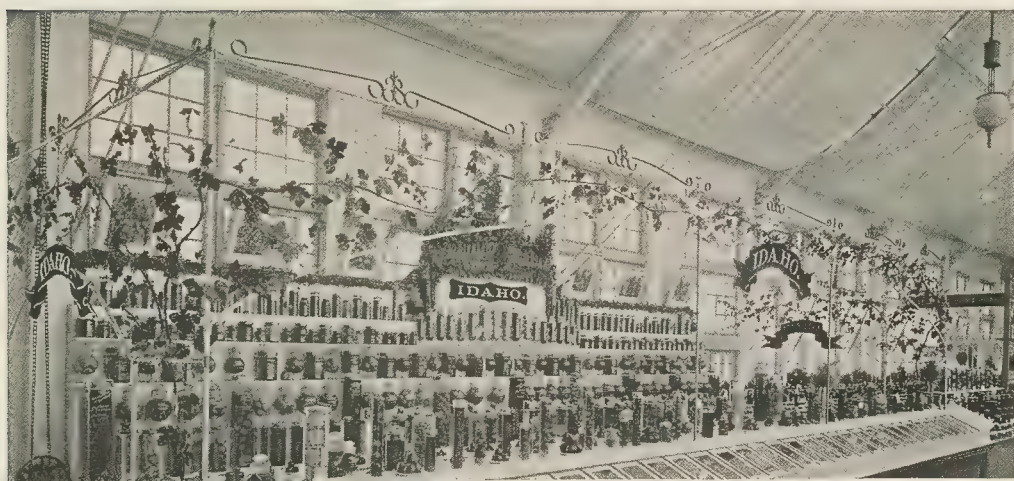
SECTION OF CALIFORNIA EXHIBIT



PRESERVED CALIFORNIA FRUIT



VIEW ACROSS SOUTH CANAL

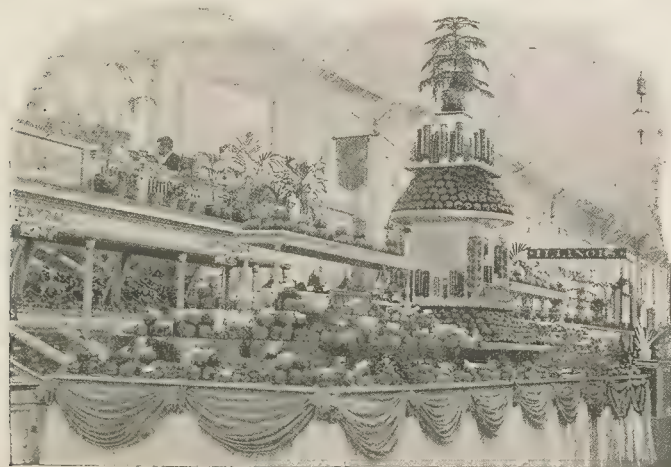


FRUIT FROM THE FAR WEST

rows of vegetables raised from the seed. Canada's space near by presents an unpretentious group of vegetables, fresh and canned, preserved fruits, and pickles. Thence eastward is the German collection of seeds, models of vegetables, garden ornaments, lawn mowers, and all kinds of garden apparatus. Three of the largest Erfurt and Quedlinburgh houses are represented in the hall, and another firm calling itself Purveyor to the Royal Prussian and Ducal Coburg-Gotha courts makes an extensive exhibit. One of the Erfurt establishments has on the screens of its pavilion a series of paintings symbolic of horticultural pursuits, with tasteful scrolls, and cornucopias, gods, and goddesses, plump of aspect, and flowers, fruits, and vegetables. in every stage of growth.

The New York firm of Henderson and company has a large assortment of seeds, and, in the form of a mound, reproduce in papier maché all kinds of market garden products. On the summit of the mound is a model of its establishment, with workmen at the windows, elevators running to and from the several floors, and customers passing in long procession through the entrance way. Henry A. Dreer of Philadelphia, and J. C. Vaughan of Chicago and New York, have also attractive exhibits of seeds, and there are smaller collections from Ohio, New Jersey, and Utah exhibitors.

Many American, French, and German establishments show, either in the form of illustrations and pamphlets, or as actual exhibits, the latest garden appliances, both for useful and ornamental purposes. There are lawn mowers of regular size and in miniature, motionless, and engaged in cutting imaginary grass from imaginary lawns. Rustic vases, stands, seats, monuments, seals, alligators, and other hideous beasts supposed to add to the attraction of garden landscapes, are also profusely displayed. From Indiana a Bedford firm sends a number of ornamental pieces composed entirely of stone, its works being in the very midst of limestone quarries.



ILLINOIS PAVILION

surgical instruments than the purposes for which they were fashioned.

A liberal space in this vicinity is occupied by California products, displayed in the form of pavilions fashioned entirely of canned fruits, towers of almonds and walnuts, and tier upon tier of boxes filled with

Seeds, vegetables, horticultural implements, dried and canned fruits, nuts, and other articles from the United States and foreign lands are mainly grouped in the northern section of Horticultural hall. In a corner adjoining the display of fresh fruits the New Jersey firm mentioned as contributing one of the most extensive and attractive exhibits in the floricultural department, erected a miniature fortress of seeds, contained in glass cases, and in thousands of paper envelopes. The summit of the glacis is covered with plume-like grasses, and beyond are



FRUITS IN SEASON

Some of the figures are works of art, as those by Leonard Volk, the Chicago sculptor, and the typical gypsy, both of which are on the roof of the pavilion. Adjoining this another Indiana firm has samples of wire net-work for fences and gates. Its pavilion is of wire, the square open-work pillars trellised with vines, and within the enclosure are piles of manufactured articles.

The French exhibit in this connection, occupying a narrow strip along the northern wall, consists largely of literature devoted to the subject, with the advertisements of houses which furnish fancy baskets, seeds, twine, and all kinds of apparatus for heating conservatories, and hot-houses. A Troyes firm has a collection of knives, shears, and pruning hooks, some of them in fantastic shapes, and suggestive rather of



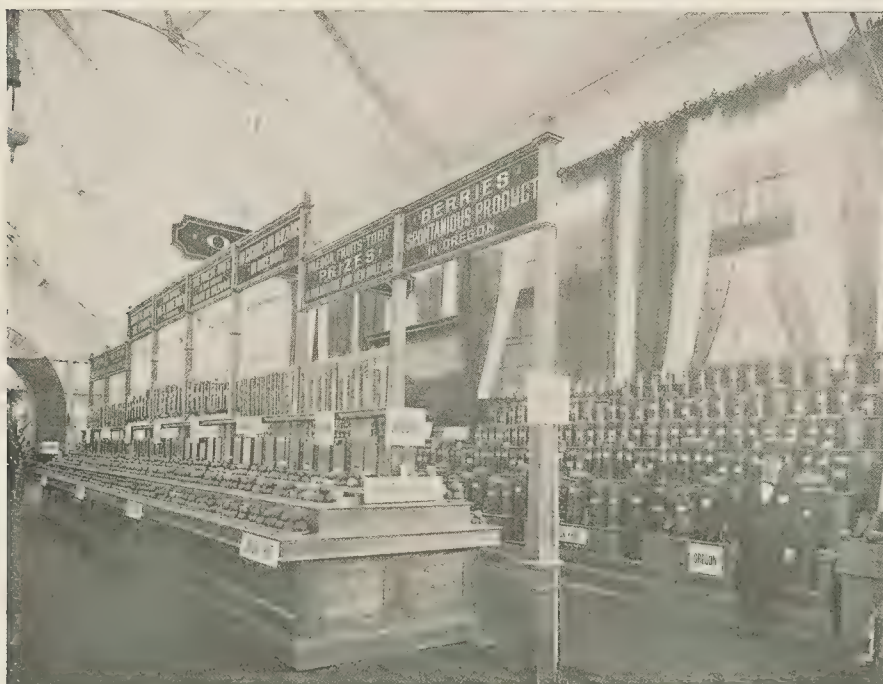
HENDERSON SEED EXHIBIT

one which contains the products of Ohio cider presses. Its contents consist mainly of the figs of Attica, the Corinthian grape or currant, and other dried fruits from mainland and Peleponnese.

Among the gallery exhibits may first of all be mentioned a tower constructed of cases of English walnuts, forming a portion of the California collections; but here also are booths filled with the canned and dried fruits of many climes. A considerable space is occupied by the San Francisco firm of Lusk and company, in whose pavilion, tastefully decorated with silken banners, are displayed all the canned fruits of the golden state. In a corner of the gallery is shown a very simple device, which is interesting many fruit growers, and has been adopted by not a few. It consists



NEW YORK EXHIBIT



THE OREGON SECTION

prunes and raisins, the last representing an industry whose growth may be inferred from the increase of pack, from 6,000 boxes in 1873 to more than 1,000,000 boxes in 1893. Of excellent quality are the prunes, and other dried fruits of Idaho, and the preserved fruits, jellies, and pickles of Kansas, and Colorado. Even the New Mexican Pueblos, the oldest of our native races, were imbued with the spirit of the day, erecting a little booth across which are printed words of greeting, and placing therein bottles and jars of preserved fruits.

New Mexico has also sent us as a work of art, a reproduction of the Horticultural building itself, in the shape of a model in silver filigree, more than 100 pounds of metal being used in its construction. In this connection may be mentioned another exhibition of fine metal and filigree work, a case filled with wreaths and flowers, closely resembling imitations in wax, displaying the skill of a German artisan. The Greek pavilion lies opposite the

of a long rod, with shears, and a canvas tube attached, so that by merely pulling a cord the stem of an apple or orange is cut, and the fruit falls into the receptacle placed beneath.

Pecans, neatly packed in cases, with photographs of Pecan bayou, as well as of the Swinden pecan orchards, at Brownwood, call attention to a prominent Texan industry. Among other illustrations, scattered throughout the gallery is one of a special train of canned fruit shipped from San José, California, and elsewhere are views of the public gardens of Bremen, and the villas of Nice. Except for its well appointed restaurants, these almost complete the contents of the gallery, or such, at least, as here need special mention.

Thus, as briefly as the nature of my subject would permit, I have described the more salient and many of the minor features in the department of Horticulture, an attractive display

to all classes of visitors, and to many the most attractive in all the wide grounds of Jackson park. For the skilful grouping and management of all these varied and varying collections, credit is due, among others, to the chief of the department, John M. Samuels, and to John Thorpe, Charles Wright, and H. M. La Rue, superintendents, in the order named, of the bureaus of floriculture, pomology, and viticulture.

In conclusion a brief description may be added as to the out-door exhibits in



CANADIAN VEGETABLES

In early winter thousands of Chinese primroses, hanging in dainty groups of variegated pink, white, blue, and red, represented the floral contributions of England, Germany, America, France, and Italy. Then came the Persian violets, richer even than the Chinese blossoms, issuing in regal splendor from the enfolding bulb. During the lenten season, the cineraria came forth in innumerable clusters, ranging in color from the purest white to the deepest purple. Crimson, yellow, bronze, and lavender calceolaria also revealed their beauties under the feeble rays of the sun, side by side with the English primrose, and the German hyacinth. Japanese ferns, trained in grotesque imitations of beast and fish, European pansies, and geraniums of many varieties helped to complete the opening chapter in the horticultural annals of the Exposition.

During the later spring, large beds of pansies skirted the Horticultural hall, and blossoms by hundreds of thousands were massed between it and the banks of the lagoon. Here were contributions not only from

New York, Pennsylvania, New Jersey, and other states, but from Germany, Great Britain, France, Italy, and Belgium. Begonias, cannas, zinnias, and phlox flashed their bright hues around

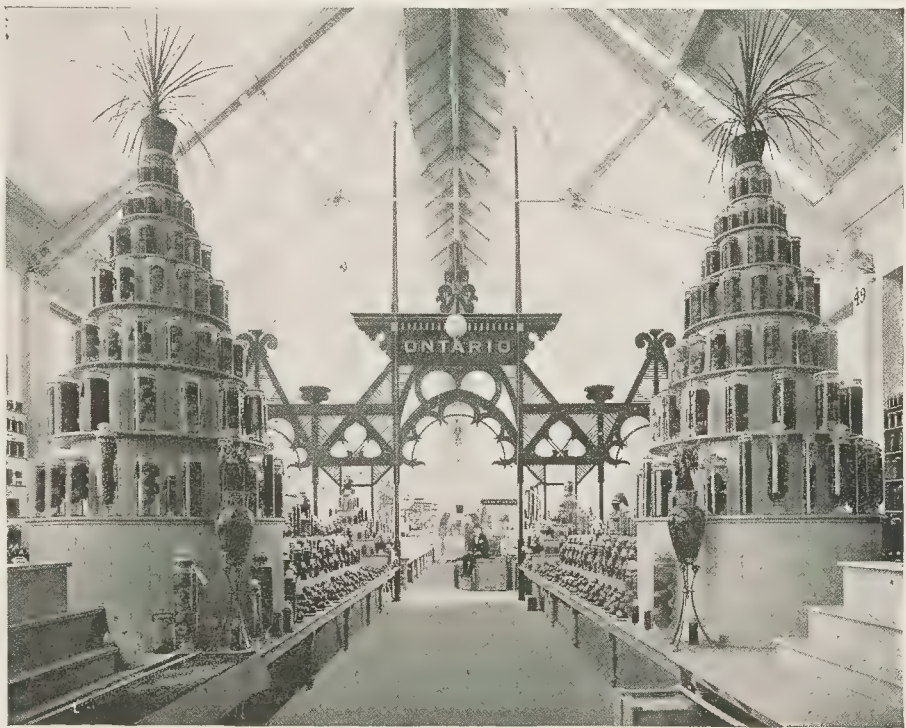
the building, these and other floral displays giving color to the home of the Fair.

In truth there was barely a week, between the months of May and October, that failed to reveal a fresh series of flowers and blossoms, rhododendrons, hyacinths, primroses, tulips, and pansies in May; roses and lilies in June; sweet peas, peonies, tea roses, clematis, and begonias in July; hollyhocks, carnations, dahlias, asters,



H. M. LA RUE

connection with this department, its conservatories, hot-houses, and grounds, with some further mention of the thousands of horticultural and other specimens, contributed in lavish profusion from every quarter of the world. During the autumn of 1892, palms, ferns, nursery trees, and decorative and aquatic plants arrived by the car-load from the United States, from Spanish-American countries, from Europe, Australia, and Japan, until winter put a stop to further shipments. Almost before the snows had melted, the greenhouses near the Horticultural building presented signs of life, and by the middle of April at least 200,000 plants had been received at the conservatories.



CANADIAN FRUITS



CHARLES WRIGHT

verbenas, hydrangeas in August and September; and chrysanthemums, orchids, and various flowering annuals later in the season. The grounds adjacent to the hall, the banks of the lagoon, and the Wooded island opposite, were mainly selected for the out-door display of flowers, which was not only the herald of the Fair but continued throughout its term. The competitive exhibit of cannas, in which New York and Pennsylvania were rivals, was the finest ever witnessed in the United States, including more than 5,000 plants, though Pennsylvania restricted her collection entirely to French varieties.

The neighboring grounds, surrounding the Woman's building, were lavishly but tastefully decorated by France, and here was well represented the floricultural art of this nation of artists, fostered, as it is, by the Jardin des Plants and the gardens of the Tuilleries, the Luxembourg, and the Museum.

But it was upon the Wooded island that the richest of the floral exhibits were concentrated. Here is a resting place, with winding walks, shady nooks, and picturesque summer houses covered with vines, with shrubbery and flower-beds at every turn, and with willows drooping gracefully toward the waters, above which sea-gulls, and other aquatic birds are flitting to and fro. Three bridges of the Venetian order connect with the



JAPANESE EXHIBIT

terraces fronting the Horticultural building, and with the southern shore of the lagoon. One of them, of Japanese design, leads from the mainland to a quaint structure at the northern extremity of the island. Here many visitors linger before this so-called temple of Hōōdo, or wander through a garden laid out with rare ingenuity. Here was the weird looking, long-petalled chrysanthemum, the national flower of Japan, and here bloomed the fragrant rose which the Japanese call *wichuriana*, before a stranger to this country. In this locality, more than in any other, the visitor was introduced to new and unusual forms of floral life.

The Wooded island was the special home of the rose; at its southern extremity was a gorgeous bed of



JOHN THORPE AND HIS FLOWERS



INTERIOR OF CONSERVATORY



FORESTRY BUILDING

these flowers more than an acre in extent, and near by blossomed fields of rhododendrons and lilies from Belgium, Holland, Great Britain, and the United States. The rhododendrons contributed by the Horticultural society of Ghent were remarkably beautiful, fully maintaining the reputation of that city as a floricultural centre. The roses came from almost every country in the world, forming the most complete collection ever gathered together, while honeysuckles and other vines were trained over the surrounding fences, appearing like solid masses of blossoms and foliage. Germany covered half an acre with her cheerful garden flowers. The holly trees and yews of England were not far away; and Pennsylvania and New York, California, France, and Austria, planted specimens from their fields and forests on this cosmopolitan island. But there was also a distinctly

American exhibit, in the form of a magnificent bed of sunflowers on the highest point of the island, their hardy faces hanging in clusters of thousands, and dispensing afar their homely fragrance.

He who is so disposed may wander over the bridge connecting, toward the south, with a smaller island, and there for a moment linger over the picturesque reproduction of an American hunter's camp, and the diminutive bark cabin of an Australian pioneer. The former is the headquarters of the Boone and Crockett club, an organization of prominent sportsmen throughout the United States, whose object is to preserve the large game of the country, especially that of the Yellowstone or National park. The structure is built of rough logs, and within, over the rude fire-



COLONNADE OF FORESTRY BUILDING



THE SOUTH FRONT

place, is the skull of a grizzly bear. On the floor are deer skins, and over the doorway are the broad, spreading antlers of an elk. Woolen blankets, skins, saddles, and lassos are strewn carelessly over rude tables, bunks, and chairs; field glasses and weapons lean against the rough walls, or are fastened to them; a pile of fuel is neatly stacked in a corner of the room; in short, there is nothing omitted from the furniture and equipments of a hunter's cabin. The camp is under charge of Elwood Hofer, who, for the occasion, was relieved from his task of capturing animals in the Yellowstone, or National park, for the Smithsonian institution.

Though officially classed with Agriculture, the Forestry exhibits will here be described in connection with Horticulture, to which department they would appear to be more akin. Though

foreign lands are also represented, the specimens are gathered mainly from the United States, whose forests, as it would seem, are not destined to remain much longer on the face of earth, for apart from other uses, some 40,000,000,000 cubic feet are annually converted into lumber, representing an industry which keeps busy

about 100,000 establishments and several hundred thousand men, with a value estimated at \$800,000,000 a year.

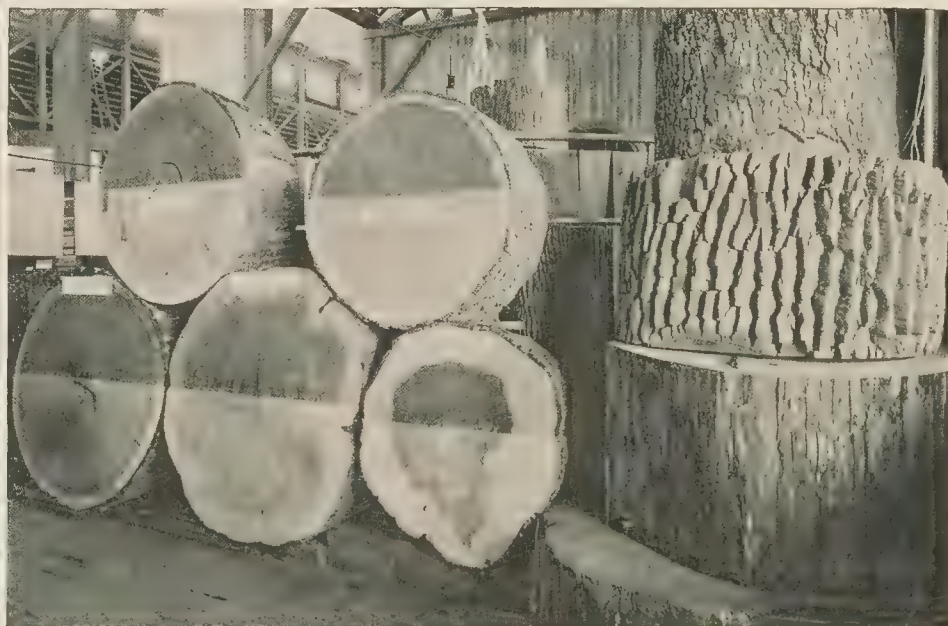
Of all the Exposition structures the Forestry building is, more than any other, symbolical of the purposes for which it was designed, forming, as it does, an integral portion, and perhaps the most interesting portion of the exhibits which it contains. A plain, unpretentious edifice, 500 by 200 feet, and with its main façade fronting on the lake, in style of architecture it is of the rustic order, its roof thatched with bark, its sides of wooden slabs from which the bark has been removed, and its entrances fashioned in various kinds of wood.



INTERIOR VIEW



MICHIGAN BURLS



SPECIMEN DISKS



LOG FIREPLACE, MICHIGAN EXHIBIT

black spruce, the bald cypress, the tulip poplar, the white oak, and the green ash. The principal minor specimens are the Ohio buckeye, the Sitka spruce, the western larch, the red alder, the arbor vitæ, red oaks, aspens, and yellow and white birches. Here are represented the forests of Canada, of the east, the south, the Pacific slope with its far northwest, including all the wooded regions from the Arctic ocean to the gulf of Mexico.

Among the most beautiful of the columns which flank the great trees are the silver maples which once grew on the banks of western rivers, or on the Atlantic coast from Maine to Georgia, and the red maples of the swamps, which still are found at intervals from Canada to the gulf. More delicate still are the birches, with bark of pure white or silver yellow. The strips which hang from the trunks seem as if covered with rime, for the birch is essentially a tree of the north. Carrying out the idea of displaying the primary forms of forest wealth in the structure of the building, its sides are composed of slabs, the frames of doors and windows being sections of logs with the bark removed. From the roofs of the verandas depend borders, or cornices, fashioned from limbs and saplings into simple geometric figures. Bark covers the roofs of both verandas and main structure, a rustic fence surrounding the latter. In the erection of the building wooden pins were substituted for nails and iron bolts, for the design of the architect, Charles B. Atwood, was to illustrate the substantial and economical work which can be done by American builders with wood alone. In carrying out this idea, and in making the building itself the primary exhibit of the department, about \$100,000 was expended, and more than 2,500,000 feet of timber were consumed.



WOODEN MANUFACTURES

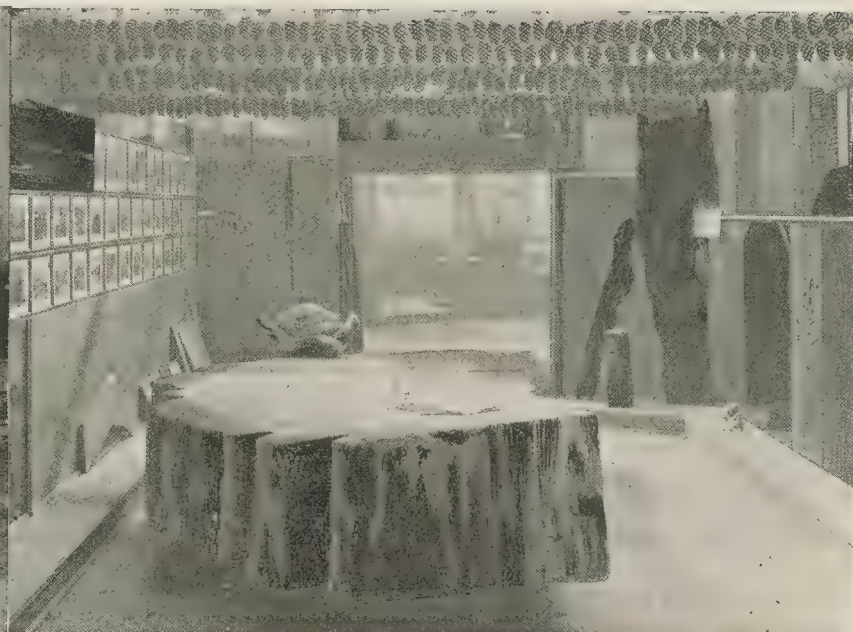


SAMPLES FROM MISSOURI

But the most unique and attractive feature in this temple of Forestry is the colonnade which supports the roof of the spacious veranda, formed of the trunks of trees twenty-five feet in height, but otherwise of different proportions, arranged in groups of three, and with the largest of each triplet in the centre. About thirty states are here represented, and the flags and coats of arms of participating nations and commonwealths appear above the cornices of the veranda. A passing examination of these columnar trunks shows that the larger specimens are of red cedar, Douglas fir, bull and white pine, western hemlock, the



SECTION OF CALIFORNIA TREE

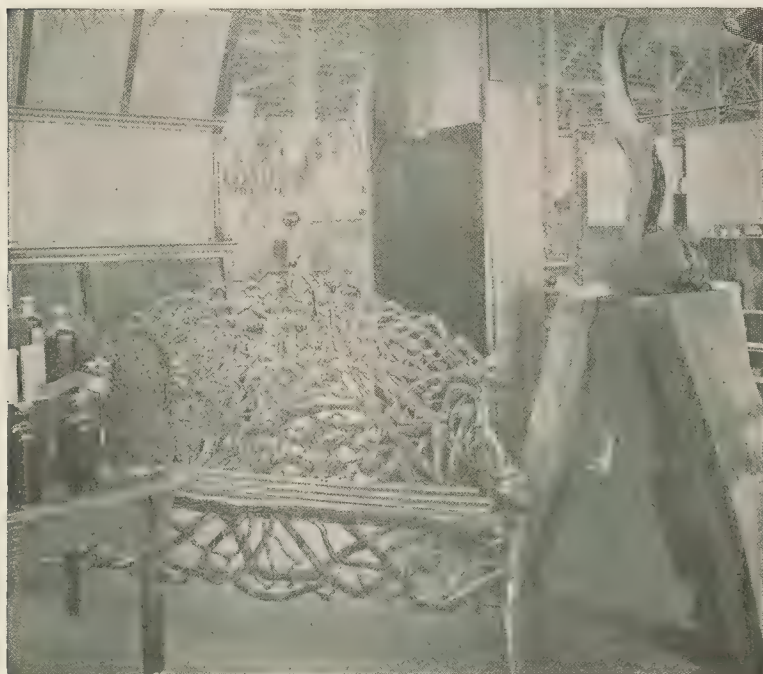


VIEW OF CALIFORNIA EXHIBIT

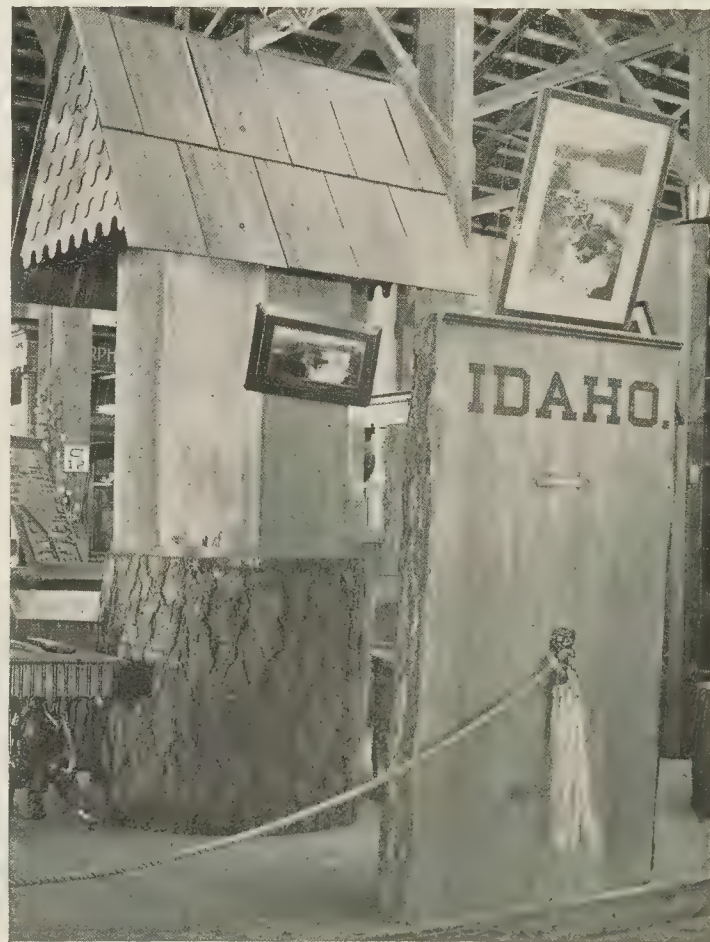
A superficial examination of the Forestry building fails to disclose any main portal, for all the doors are square, and of similar pattern. Once within, however, the visitor soon discovers a spacious vestibule fronting the east, which may be considered as the principal entrance. Here is an illustration of the decorative qualities of yellow pine and cypress from the Southern Lumber Manufacturers' association, the sections of wood forming the square pillars and panels of the dado, the round columns above, the rich border of cypress, and the ceilings themselves, being highly polished, and dressed so as to show all the details of graining.

Passing thence, the visitor finds most of the massive exhibits fronting the vestibule, or grouped in its neighborhood. Around him are the products of the forests of Michigan, Wisconsin, Washington, West Virginia, North Carolina, and Missouri, and before him gigantic sections of pine and hemlock from Canada, and slabs of polished woods from the wilds of Australia, while in the very centre of the hall is a massive monument containing specimens from all the exhibiting states and countries. Scores of huge blocks, and polished sections of wood are arranged around the mammoth redwood from California, which has carried away the honors of the entire display, an arrow, and the head of a brass tack upon its face indicating the diameter of the tree at the time of the event which the Exposition celebrates. Another object which attracts almost as much attention is one of the axes which England's premier uses so vigorously upon the trees of his Hawaarden estate.

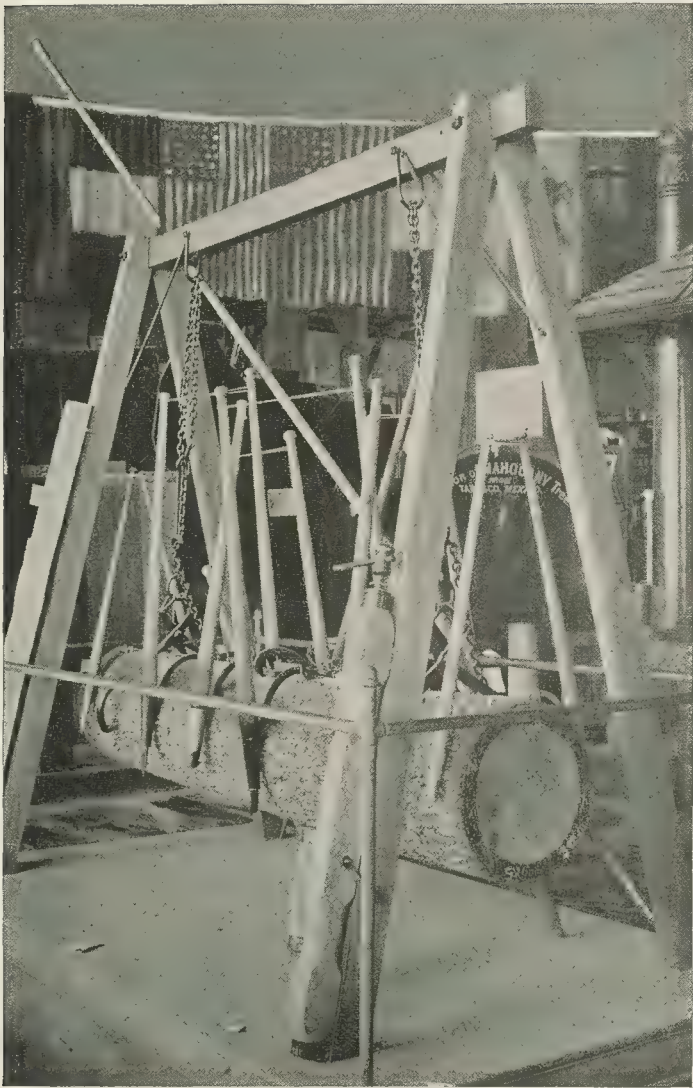
To the northeast of the vestibule are the evidences of Michigan's forest wealth. A rustic gateway gives entrance to the exhibit, the cabinet which incloses it being highly polished, and neatly panelled bird's eye maple, oak, elm, walnut, and other varieties entering into its construction. An odd conceit, and one deftly executed, is that of placing



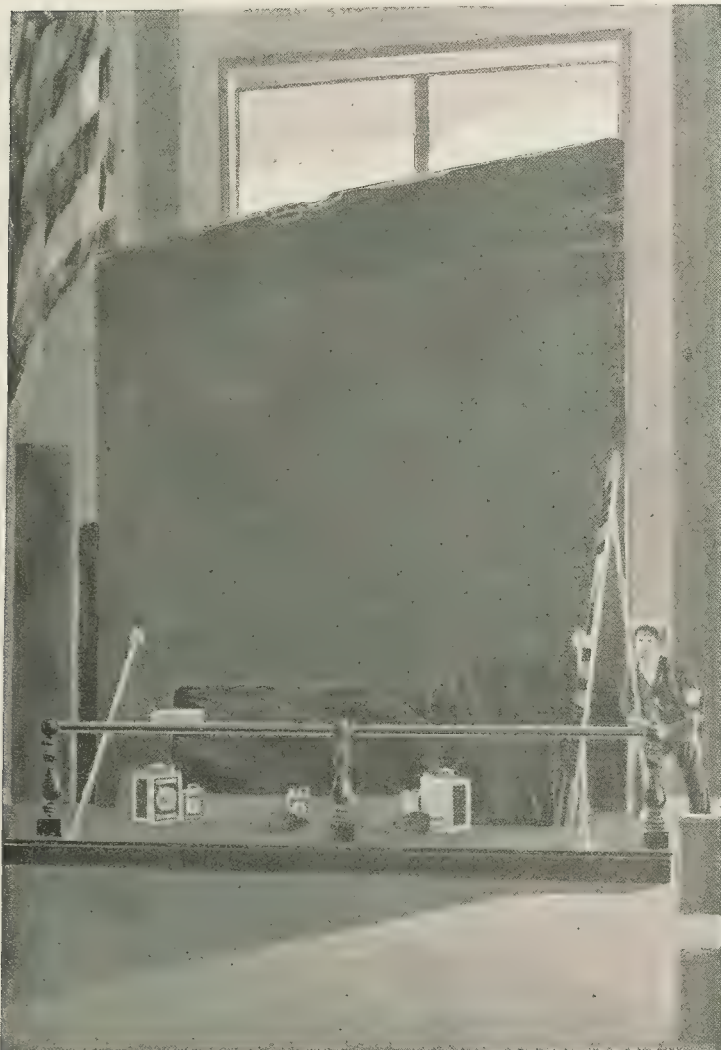
SETTEE IN NORTH CAROLINA SECTION



IDAHO'S PINE



LUMBERING TOOLS



RED WOOD PLANK FROM CALIFORNIA

in the cornices several transverse sections of small logs, with the bark only removed, hatchets, saws, and compasses carved out of wood appearing at various points, and completing the decorative scheme. Over the main entrance is the symbol of the state, two stags engaged in combat with an eagle between them, and specimens of pine, cedar, and poplar are contributed by her experiment station. The furniture factories of Grand Rapids and other cities of southern Michigan find in the specimens of walnut, oak, maple, and pine here displayed, one of the secrets of their success. In a small photograph gallery within the pavilion are shown the enemies of Michigan woods, one view depicting the ravages of the web-worm upon the poplars of a city avenue, every leaf being stripped from the branches, while upon the opposite side of the street is a row of flourishing maples exempt from the plague. In a corner of this section is a rough fireplace made of logs, and in the centre a miniature fortress of gnarled trees. Various forms of manufacture are also represented, as sulphite fibre, basket-work, and wooden-ware.

Wisconsin has erected a neat pavilion built of her native woods, with six varieties in each of the twenty hexagonal columns which support the birch bark roof. The floor is of cherry and birch planks, and between the pillars are two-score blocks of timber which have a commercial value. In the centre of the structure are logs of pine, oak, and other varieties, with smaller sections arranged on stands. In branches and seeds are also represented the pine, spruce, birch, and hemlock forests of northern Wisconsin, as well as the cultivated elms and other ornamental trees of the southern portion of the state. Upon the walls and scattered throughout the specimens are many colored pictures and photographs depicting scenes in logging camps, saw and lumber mills, showing some of the largest loads of logs which have ever been hauled from western forests, one of them twenty-one feet high and twenty in width.

A score of people might stand in one of the mammoth disks of cedar which Washington has laid upon the floor; and this is by no means the best that the forest of the evergreen state can do, though here as in her own building is an imposing display. Missouri woods include many varieties, with rough sections of trees and others dressed and polished, among which may be noticed the delicate graining and tinting of the holly, aspen, yellow cypress, and silver maple. This exhibit is inclosed by a wall of tree trunks cut in regulation lengths, including about 150 massive specimens.

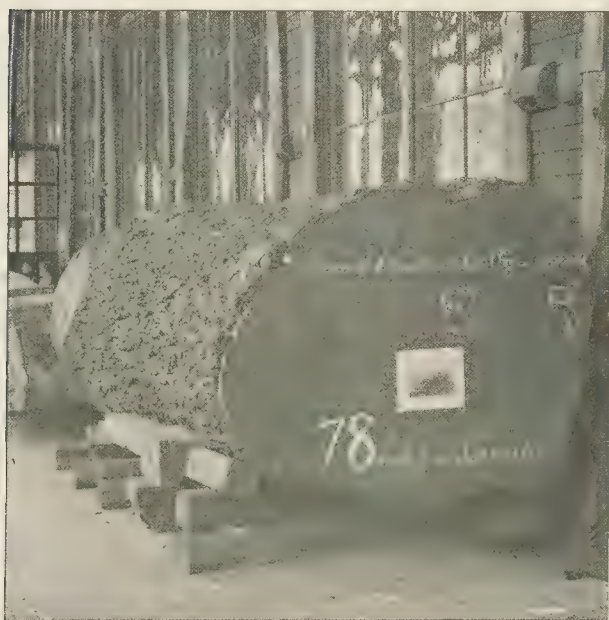
In an adjoining section, the forests of West Virginia are displayed in a collection of photographs. Forests of pine, spruce, chestnut, beech, oak, cherry, and black gum, and logging scenes in the mountains, and along the rivers, are all represented by the artist, and there is a circular tower of woods with gigantic poplars and tulips at the base. A lumber company shows hardwood, capable of taking a beautiful finish; a Parkersburg mill company has an exhibit of brush handles and wainscoting, and the Standard Oil company one of the barrels used in its export business.

North Carolina has an extensive and varied display, rugged specimens and photographs of timber trees conveying an excellent idea of her forest growth. Here also is a large display of nuts, seeds, cones, and bark, and a small collection of balsam, turpentine,



HOUSEHOLD WOODENWARE

hemlock belt ranges from an altitude of 2,700 feet in British Columbia to 10,000 feet in the sierra of central California; that the Douglas fir grows from 200 to 300 feet in height, and that it is the most generally distributed timber tree of the Pacific coast; that the arbor vitae flourishes best in the swamps of the north, and the cottonwood on the banks of the Ohio river, and that the balm of Gilead species has as its territory Canada, the United States westward to Colorado, and the entire northwest as far as the Arctic ocean.



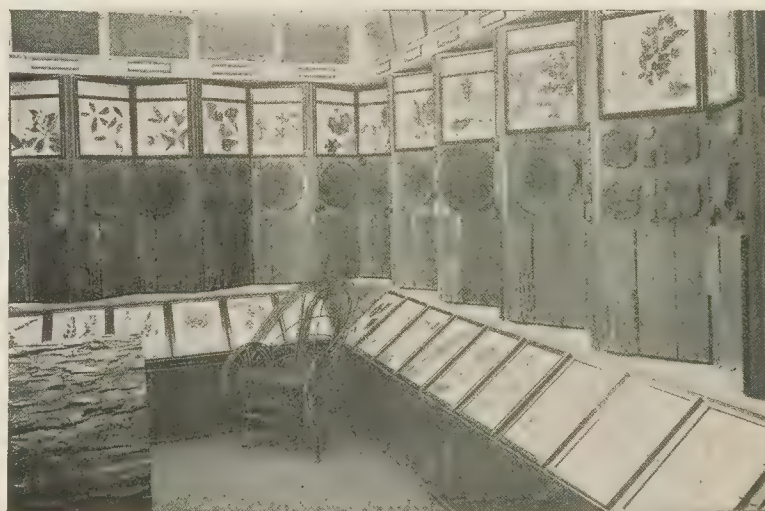
WALNUT LOG FROM KANSAS

and other products of the pine, for which the state is noted. The exhibit is arranged in a series of cabinets, the bases of which are composed of native woods, and the upper portions of large photographs of the forests from which they were cut, some of them 7,000 feet above the level of the sea. A valuable feature in this section is the views which illustrate the results of scientific forestry, as conducted on the Asheville estate of George W. Vanderbilt. In one of the corners is the graceful form of the palmetto tree, the symbol of the sister state, which is not represented in this section of the Fair.

Among the many interesting groups lying south of the main vestibule are the Jesup collection of American woods, and the exhibits of California and New York. The Jesup collection is a duplication of the cabinet in the New York museum of natural history, similar in scope to the display of native woods in the Government building. Each of the 430 specimens is labelled with an outline map, showing the area in which the tree is indigenous, together with a description of its characteristics. Here, for instance, one learns that the



CORNER OF MINNESOTA SECTION



INTERIOR OF OHIO PAVILION

In the adjacent exhibit of California

the redwood, laurel, walnut, maple, elm, locust, madrona, and the so-called big trees stand row by row like gigantic sentinels, their faces polished, and displaying all the beauties that timber can be made to assume. To many visitors these are somewhat of a revelation, for here were for the first time shown to them the excellencies of California woods for cabinet and ornamental purposes. Here also are festoons of cones, burls of curious shape, and an unadorned section of a redwood that might serve for an ordinary table.

The New York state exhibit, which occupies a large space in the eastern portion of the hall, presents a striking illustration of the forest growth of the empire state. In revolving frames are thin sections of her trees, with their seeds, bark, and leaves, and within each frame are photographs, one showing the tree from which the

different parts were taken, and another a portion of the trunk. Among the collection are such varieties as the Norway pine, the English cherry, hickory, spruce, balsam, balm of Gilead, fir, tamarack, larch, hawthorn, cedar, sycamore, black walnut, poplar, hackberry, birch, elm, ash, maple, and chestnut. Many of these are also reproduced in photographs, together with landscape scenes adjacent. Another feature in the New York exhibit is that which shows the texture of different woods, and different portions of the same wood. Sometimes the specimens do not exceed the twelve-hundredth part of an inch, and when placed against the light not only show forms of geometric combination but reflect colors of exquisite tint, and when examined under a microscope even greater wonders are revealed.

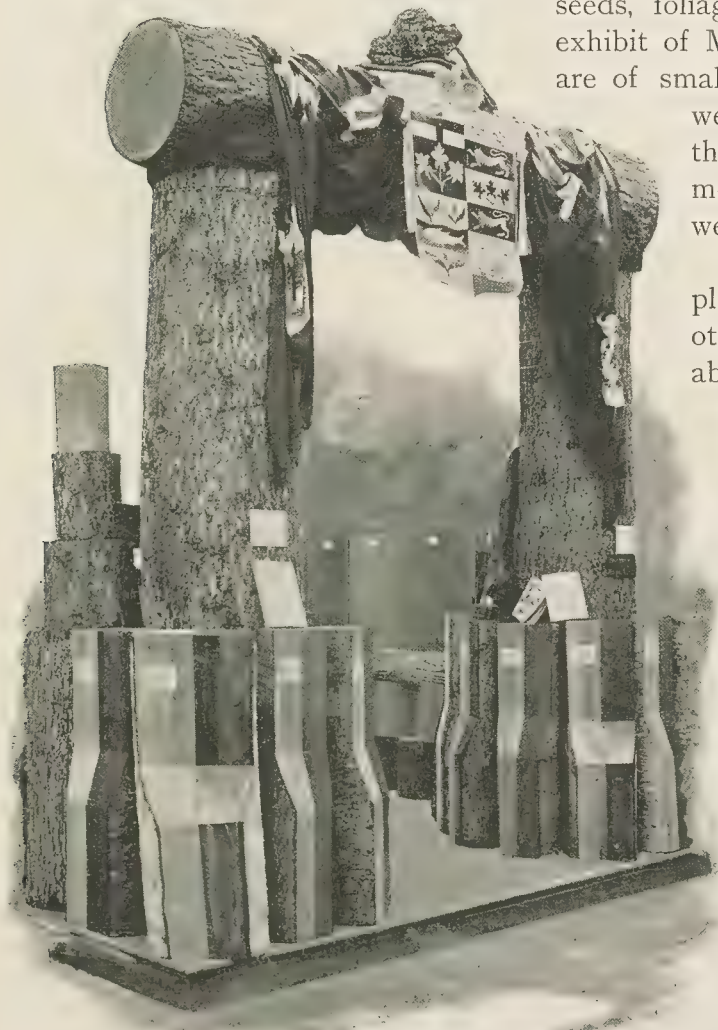
In the southern section of the hall Connecticut has a rustic booth of cherry wood,

its specimens of burl oak, walnut, pine, ash, hickory, etc., in sections of which one side is polished, and with seeds, foliage, and twigs as adjuncts of the display. No less artistic is the exhibit of Massachusetts, both of them demonstrating that while eastern woods are of smaller size the grain is finer, and the timber more durable than in western varieties. A New Jersey firm in this vicinity shows some of the uses of eastern spruce and poplar in a group of tubs, pails, bowls, measures, and pans, pressed from the pulp of these woods, and said to wear like metal, besides being odorless and seamless.

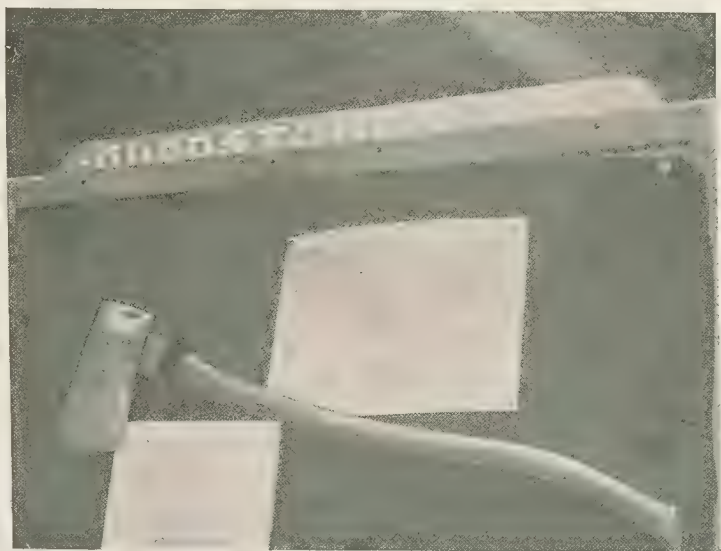
In this vicinity Colorado places a giant poplar cut from the first tree planted under her timber culture act of 1877. Great firs, spruces, and other varieties form the corner pillars and base of the booth, while above are the trunks of such trees as the black-thorn, dog-wood, hackberry, wild cherry, black cottonwood, dwarf birch and maple, hazelnut and mountain mahogany, some of them taken from the cañons of the foot-hills, and others from the mountains thousands of feet above. In a series of frames are sprigs from the yellow and fox tail pine, the black birch, red fir, cedar, sage brush, box elder, and quaking aspen; also a row of jars filled with buffalo berries, wild plums, choke cherries, and seeds of

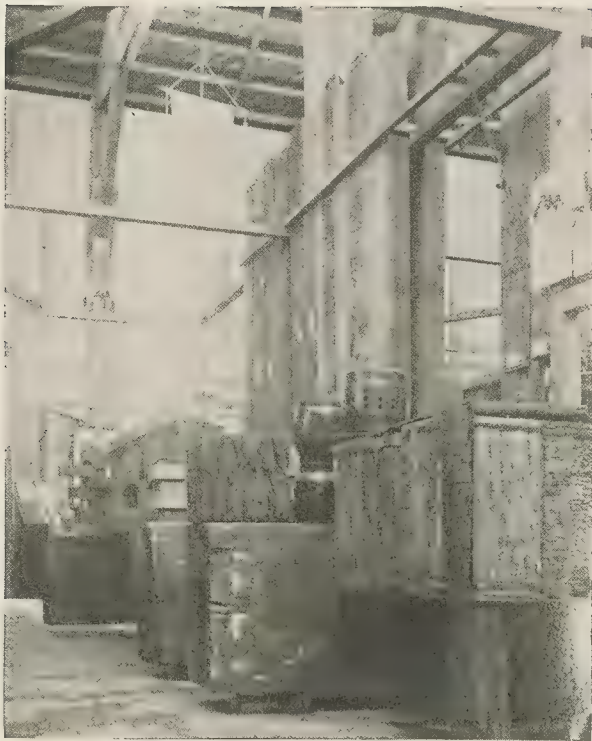


CANADIAN EXHIBIT



ENTRANCE TO QUEBEC SECTION





SLABS FROM AUSTRALIAN FORESTS

the Douglas fir and balsam. The bulk of the silver state's exhibit comes from her agricultural college.

Close to the Connecticut pavilion are the exhibits of Florida, Arizona, and Idaho, the woods of the peninsula state being mostly furnished by railroad companies. Those of Arizona and Idaho consist mainly of pine, the former state asserting that while

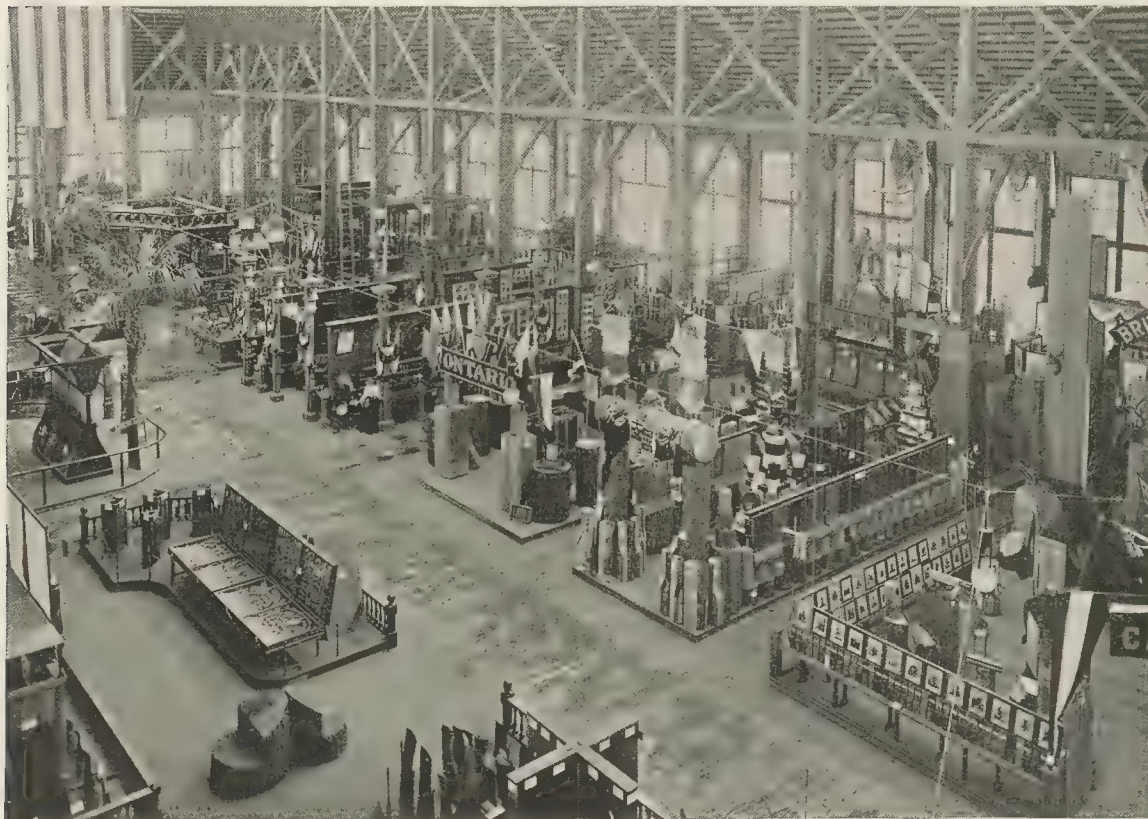
she has been called a treeless desert, there are within her domain 2,000,000 acres of pine untouched by the woodman's axe.

In the southern portion of the hall of Forestry are grouped the individual exhibits, one corner being filled by a mammoth redwood wine tank, constructed within the building by a San Francisco firm. Across the way is a pyramid of tubs, pails, and other wooden ware from a Chicago house, and near by is a large assortment of wooden knives, forks, rolling pins, scoops, bowls, and medallions. A pulp and paper company shows in a series of jars, with explanatory labels, the processes through which spruce chips pass, from the crude material to the bleached pulp, and to colored rolls of paper.

Not far away are booths in which is shown cork in various devices, some of them approaching the artistic, such as pictures made of the shavings and other fine sections, one of the exhibitors reproducing St Peter's and picturesque scenes on the Rhine, with remarkable fidelity. Among other exhibits are trees in their natural state, and trees of which nothing is left but their outer coverings, or the portions from which the cork is cut. There is cork piled up in slabs like cord wood, and cork tables, towers, and pavilions.



ENTRANCE TO ONTARIO PAVILION



ONTARIO EXHIBIT

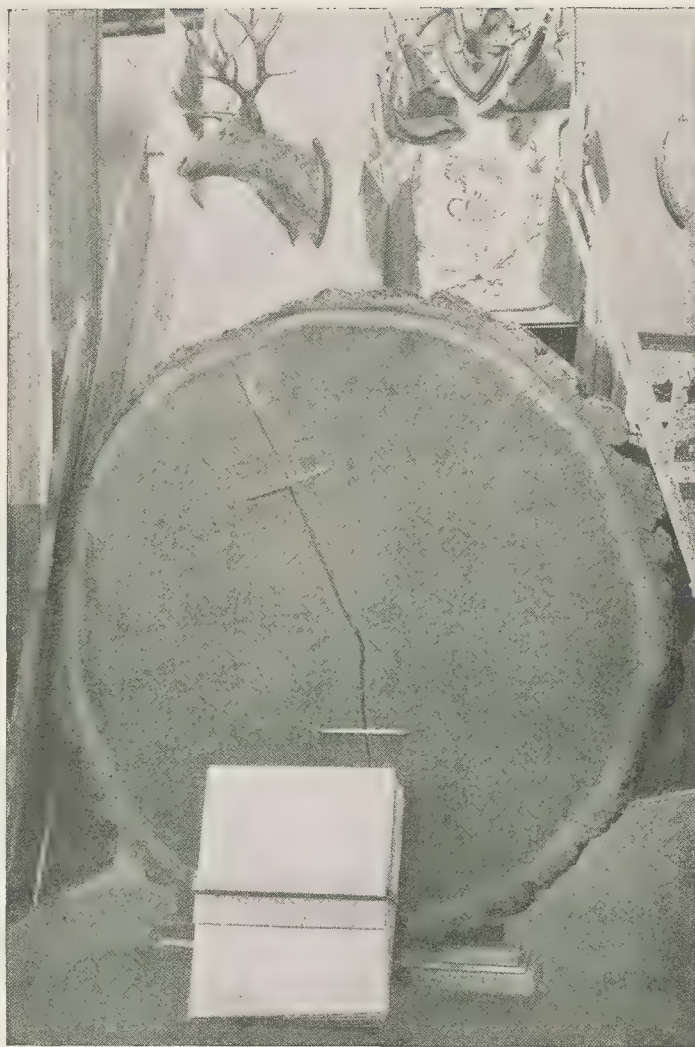
Near these are specimens of wood-turning, in the form of snakes coiled for attack, billiard balls, charms, watch-chains, stair and chair ornaments, flowers, and nearly everything that has been accomplished in the way of decorative wood-turning. A choice and varied display of foreign woods is that of the E. D. Albro company of Cincinnati. Upon a large platform, above which are the flags of many lands, is grouped an array of polished slabs, such as are used in cabinet work. Surrounding the platform are rows of upright posts, cut from valuable timber, as the ebony of Ceylon, the red Brazilian tulip, the

rich brown lignum vitæ, the fine grained and yellowish shittim from Palestine, and the Amazonian cocobola, rosy red, and with patches of gold near the bark. Piled high upon the platform are slabs of mottled brown Persian walnut, yellow Brazilian satin-wood, the Turkish ash, and the white mahogany of Mexico with its delicate cream color. Near by is a collection of implements, such as are used in lumber regions, and adjacent to these a group of household appliances in structural form, manufactured from the aromatic cedar of Virginian forests. A Detroit firm displays a large plank from a California redwood, with the oil finish of which it makes a specialty. A Chicago establishment has a pavilion composed of many varieties of wood, in the finishing of which its varnishes are used, and a manufacturer of wooden faucets, saturated with india rubber, has a structure built of bark, with arched doorway whose keystone is of cork.

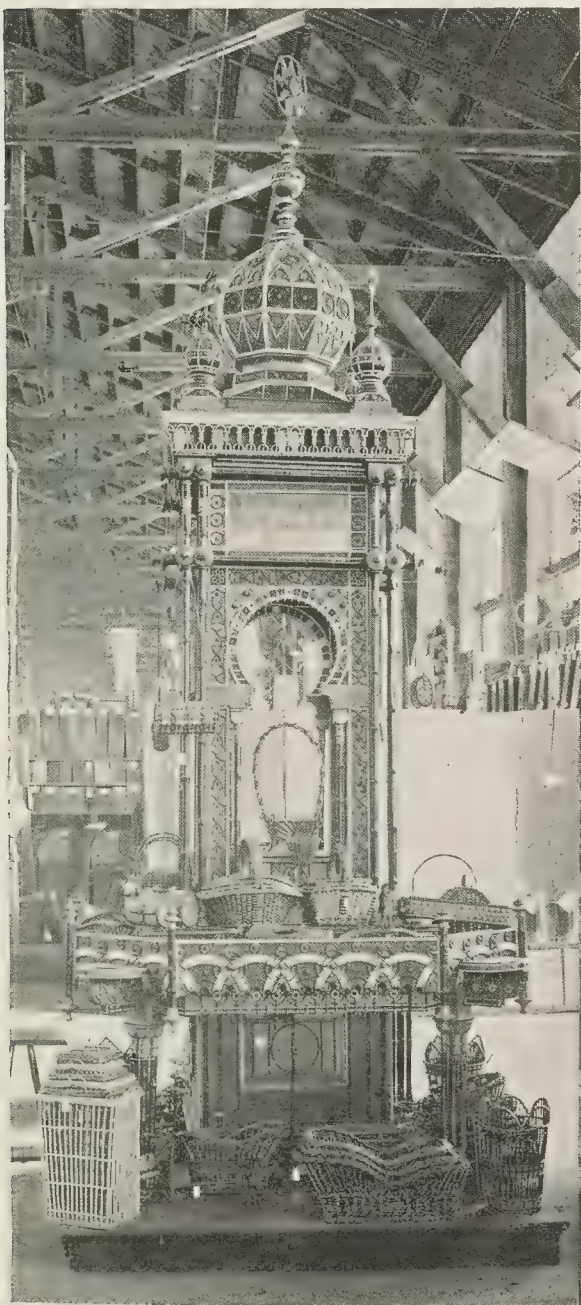
The northeastern quarter of the Forestry building contains, in addition to the exhibits already described, those of Pennsylvania, Ohio, Wisconsin, Minnesota, Nebraska, North Dakota, Oregon, Virginia, Louisiana, and Kentucky. The display of Louisiana, whose forests are yet almost untouched, forcibly illustrates one of the great resources of the southern states. The pavilion is of cypress, pine, oak, ash, and other native woods, surmounted with a cupola, and with pillars and ceiling handsomely carved and inlaid. In the

decorative scheme are reproduced the leaves, flowers, and branches of Louisiana trees,

and within are represented in various forms her sturdy oaks, her lofty pines, her graceful willows, her rapid-growing chinias, and stately beeches and ash, with the creamy-blossomed magnolia, the fan-like palmetto, the wide-spreading elm, the moss-hung cypress, and the odorous cedar. Some of the specimens are in the form of large square blocks, one side retaining the bark, and the other showing the wood stripped of its outer covering, with samples of hewn timber, such as reveal the beauties of the polished surface. Upon the blocks are partially manufactured articles, illustrating the uses, commercial and ornamental, to which the wood may be put. An interesting series of maps and charts explains how the timber is cut and floated along an intricate system of bayous to the saw-mills on the Mississippi.



DOUGLAS PINE FROM BRITISH COLUMBIA



WILLOW WARE IN GERMAN SECTION



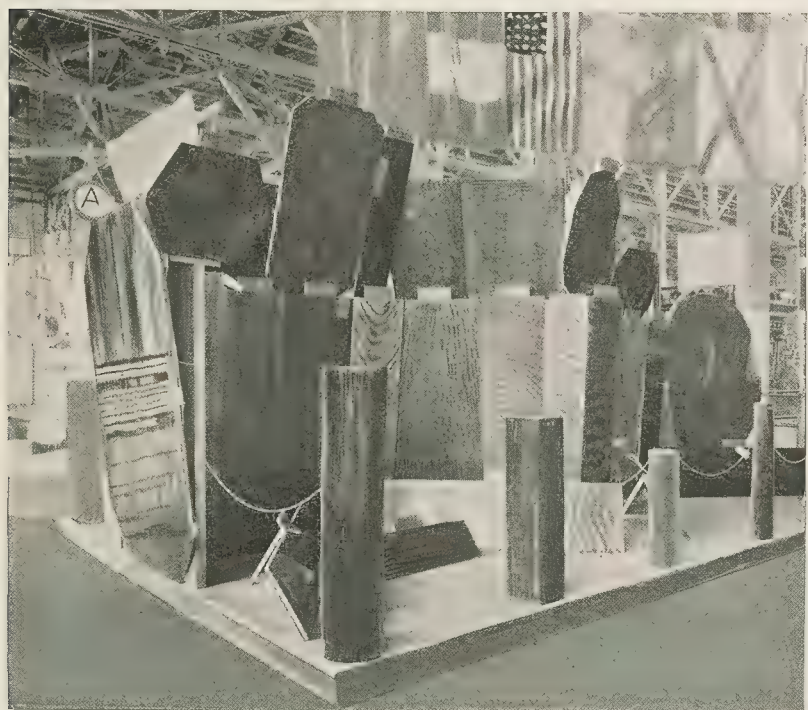
FRENCH WILLOW BASKETS



THE ADMINISTRATION PLAZA

Virginia has but a scant display of forest woods, while Kentucky is somewhat of a surprise. The entrance to the latter section is through a hollow segment of a sycamore tree, sixteen feet in diameter, which grew in the neighborhood of Fairview, the birthplace of Jefferson Davis. To the right is a huge yellow poplar; to the left a great white oak, and in a series of pyramids are native woods in 150 varieties, while in a relief map are shown the timber areas, the logging streams, and other matters connected with the lumber interests.

Minnesota has also an interesting exhibit in her rustic pavilion surrounded by a fence upon which are perched in life-like form, birds, gophers, and other specimens of her fauna. The display is of an instructive rather than a massive character, such as might have been expected from her boundless forests, and the numerous industries connected therewith. A few blocks of pine there are,



POLISHED FOREIGN WOODS

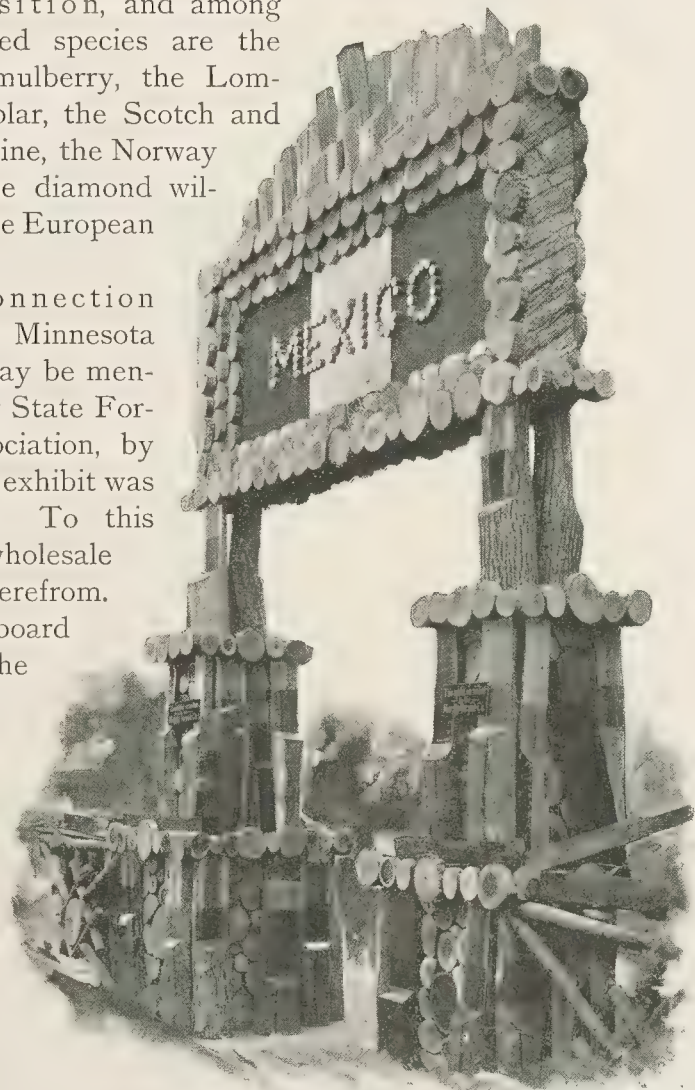
bearing carved stars upon their faces; but elsewhere are only simple specimens of cultivated trees. A section of European larch is shown, which is said to have grown further north than any tree of its kind. A block of Minneapolis cottonwood is historic, for it was hewn from the first tree planted in that city, nearly forty years ago. All the native varieties are on exposition, and among transplanted species are the Russian mulberry, the Lombardy poplar, the Scotch and Austrian pine, the Norway spruce, the diamond willow, and the European larch.

In connection with the Minnesota display may be mentioned her State Forestry association, by which the exhibit was organized. To this

institution credit is due for its efforts in calling attention to the wholesale destruction of forests, and the climatic and other evils resulting therefrom. It has also repeatedly urged upon congress the appointment of a board of forestry commissioners for protective purposes, and to promote the science of arboriculture. Among the purposes of the Forestry department of the Exposition is to collect information from every quarter as to the amount of valuable standing timber, the effect of forest destruction on climate and soil, and the results which have followed the adoption of various timber culture acts. It is intended to demonstrate the wealth of our forests, ascertain the ratio of consumption and destruction, and the efforts made to counteract this destruction, through the preservation of timber tracts, and the planting of new areas. This is accomplished not only in the exhibits themselves, but in maps, photographs, reports, and literature devoted to the science of forestry. Nebraska and North



INTERIOR MEXICAN PAVILION



PRINCIPAL ENTRANCE

Dakota especially demonstrate the benefits of tree-culture, and one of the most prominent objects in the former section is a life-sized portrait of J. Sterling Morton, to whom Arbor day owes its origin, for many years a resident of that state, and now secretary of the national department of agriculture. The Nebraska pavilion is of the rustic order, with a mammoth cottonwood disk at one of the entrances, and on arches and pillars,



MEXICAN MAHOGANY BLOCK

composed of cottonwood, linden, honey locust, ash, and elm, are sprigs of green grown from the trunks since they were placed in Forestry hall. One of the curiosities here displayed is a horseshoe embedded in the heart of a big cottonwood hung on one of its limbs a dozen years ago, and imprisoned by its growth.

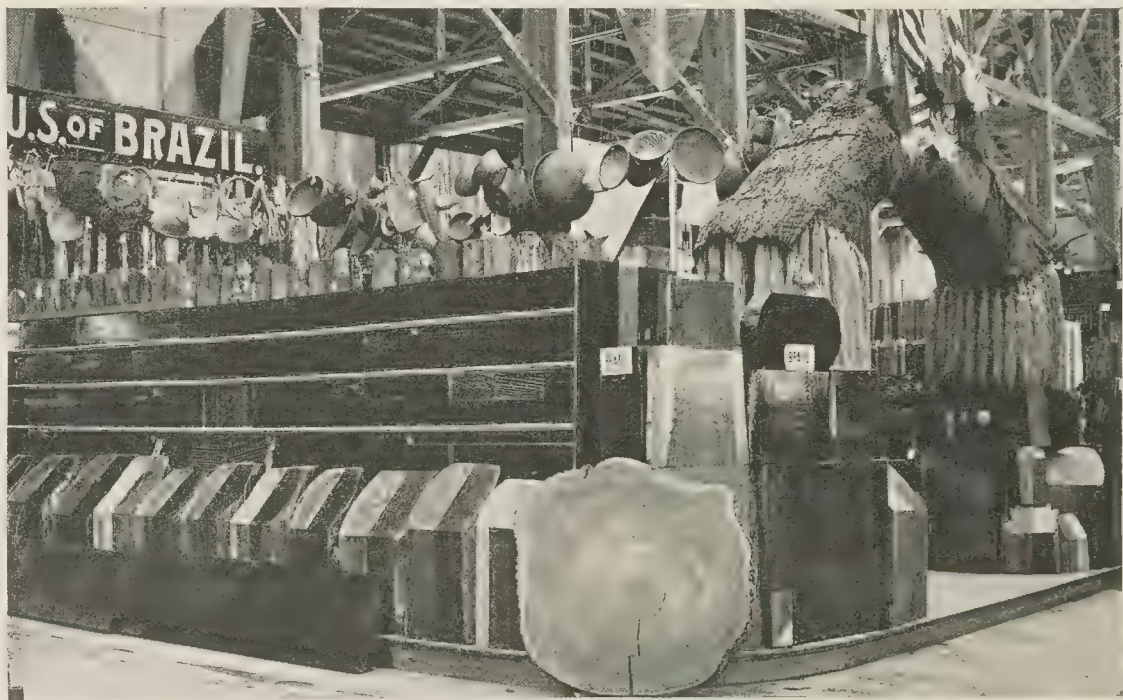
In the huge logs cut from planted trees exhibited by North Dakota, is shown what may be done in the way of arboriculture on prairie soil. A thick section of bark forms the back of a chair, the body of which is hewn from the trunk, and the various specimens are labelled with the ages of the trees, and the conditions under which they were planted. Near at hand is the square pavilion in which Ohio presents a complete display of

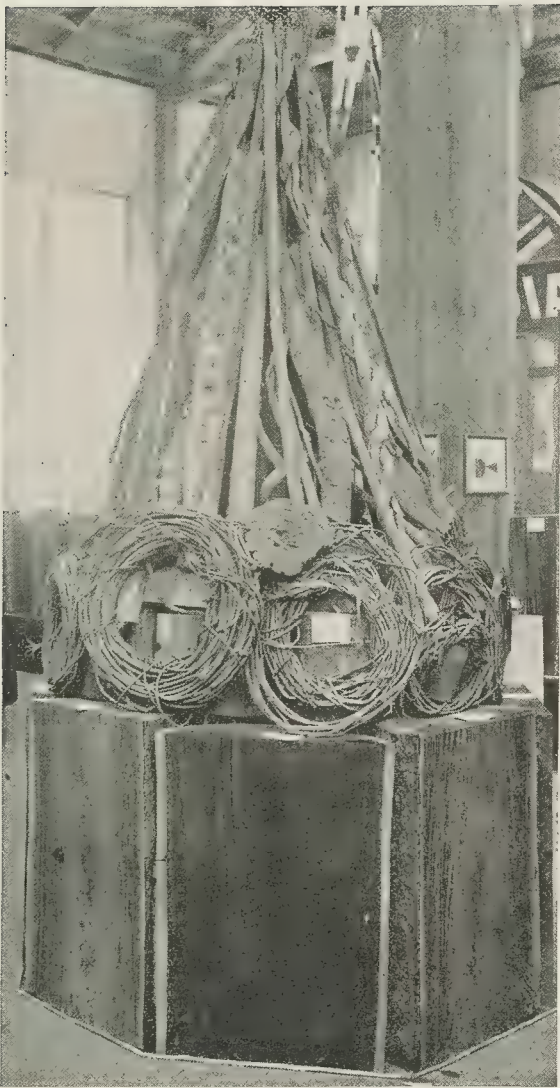
medicinal plants, with more than eighty specimens of native forest trees in the form of twigs, leaves, flowers, fruit, and section of trunk and bark, in the rough and polished; the latter profusely illustrating the graining of woods suitable for turning, cabinet work, and interior finish. The walls of this structure are covered on both sides with framed specimens of herbs, bark, twigs, flowers, fruit and foliage, the pillars forming samples of rough wood, and polished slabs the panels below the cornice.

At the northern end of the Forestry building Pennsylvania shows several hundred varieties of her native woods, together with a model saw-mill, with logs being drawn up its front incline, and in the yards behind piles of finished lumber, while on the roof are rows of water barrels as a safeguard against fire. Into the Oregon booth adjacent, the visitor enters between huge sections of yellow fir and spruce, the latter cut from a tree 305 feet high, and 16 at the base. Within, the commission has a beautifully finished office, the side walls formed of polished planks of fir and spruce, contributed by the lumbering and mill companies of Astoria and Portland.

In the northwestern portion of the Forestry building is a collection of cedar, pine, oak, cherry, cottonwood, and other varieties from the territory of Utah, one that seems out of place, pushed aside, as it is, into a corner among the foreign exhibits; for here is a valuable exposition of what can be done in the way of tree-planting under most adverse conditions, and nowhere has arboriculture been conducted with more of system and success.

Almost in the centre of the western division of the hall are the exhibits of New South Wales and Canada. In the Australian collection are more than ninety varieties of hardwood, enclosed by upright planks, polished to a distance of six feet from the floor, and forming an excellent sample of antipodean workmanship. From the top of the booths float the flags of the Australasian colonies, and above all is an ensign bearing the inscription "Advance Australia," which is seen in many other departments of the Exposition. The outer wall is largely composed of the most valuable of Australian timbers; ironbarks, red, grey, white, and black; gum trees, spotted, grey, blue, red, and white;





JAPANESE SLABS AND FIBROUS WOODS

woods, and a model of a church, also designed to display the variety of her forest products. British Columbia, whose pavilion is adorned with the heads of deer, has several of the largest sections of Douglas fir contained in the Forestry building.

In the French section, adjacent to the Canadian groups, are specimens of cabinet woods, cut veneers, osier work, and mosaics in wood, fashioned and grouped with the skill and taste of the Frenchman. In paintings, photographs, and maps are scenes among the picturesque regions of the French Alps, thickly clad with the pine forests which the government protects with zealous care. There is also an excellent display of conifers, and of such forest products as pitch, tar, and resin.

The German collection is in the northwestern portion of the hall, grouped, for whatever reason, among

those of South American nations. This exhibit may be considered as the chief exponent of scientific forestry, as represented at the Fair. In maps are shown the forest distribution in many portions of the empire, the changes in their condition under forest management, during a large number of years, and the temperature of the soil within and without the forests. Instruments are displayed recording the temperature of the soil, and measuring the growth of trees, and there are models of logging railroads and tree-planting tools. In a chart prepared by the royal forest inspector of Bavaria is explained the nature of the soils in his territory, and the experimental station at Munich describes, in an object lesson, the ravages of the



ENTRANCE TO JAPAN SECTION



INTERIOR JAPAN SECTION



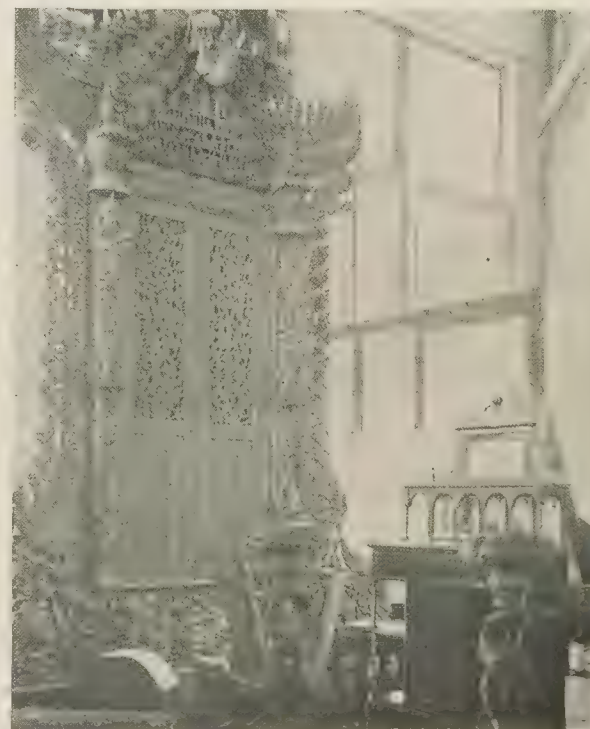
SIAMESE EXHIBIT

pine moth, while the forestry schools connected with the universities contribute to the interest of the display. There are also specimens of tannin and tannin extracts, basket ware, cork, and that which is made of cork.

Germany may be considered as the mother of scientific forestry among European countries. In the seventeenth century arboriculture was studied by her learned men, and a hundred years later was being systematically taught in her colleges. Meanwhile the movement had spread to Russia and Austria, and later, schools of forestry were also established in France and Spain, where before the application of remedial measures, many of the mountainous and wooded districts, formerly supporting large populations, had become almost deserted. To-day, apart from the United States, the governments of all the leading countries in the world so manage their forest tracts as not only to insure their preservation, but to derive large revenues therefrom. France has 7,500,000 acres of national forest lands, and individuals nearly twice that area. One half of the 20,000,000 acres of Prussian timber lands produces a net annual income of \$6,500,000, while Saxony's 400,000 acres yield a return of more than \$1,200,000. Here in truth are lessons which our own republic might profitably lay to heart.

In the Russian section, photographs and maps convey information as to the areas covered by forest lands, and also reproduce the imperial hunting parks, and the pavilions erected thereon. Leaves and seeds are displayed in mounted specimens, and the department of the Volga furnishes models of the ovens used for boiling pitch, and the rafts that convey it to centres of shipment or consumption. The St Petersburg institute of forestry sends a collection of wooden implements from the peasantry, and the government of Kazan has a collection suggestive of the apiarian industries of that section of the empire.

Adjoining the New South Wales section, Mexico shows her woods, roots, fibres, dye-stuffs, and medicinal products. Four hundred different species of native woods are here displayed in the 2,000 polished specimens contained in a simple, rustic pavilion, its square main entrance, composed of disks, presenting a unique appearance. Resins, vegetable wax, copals, such as are used in the manufacture of varnish, and chewing gums, add variety and interest to the exhibit.



CARVED DOOR OF TEAK WOOD



LOGGING TRAIN

Tocantins, a tributary of the Amazon, a separate structure within the pavilion being composed of specimens from the forests of the great river. Among the collection are also samples of inlaid wood-work and basket-work.

Of somewhat similar character are the exhibits of the Argentine Republic and Paraguay, each having some 300 varieties of wood and many medicinal plants. In the Argentinian section is a crocodile dragging its unwieldy frame over a mahogany stump. The main collection of woods is in the form of a truncated pyramid, surmounted by an octagonal block of fragrant cedar.

Crossing the central nave we come to the exhibits of Spain, the Philippine Islands, and Cuba, the features in which are the huge square timbers of Cuban mahogany, and the Spanish collection of native woods and corks. Close to the northern portal of the Forestry hall is an enclosure surrounded by a high bamboo fence, within which are the choicest of Japanese forest products. A special effort is made to show the adaptability of the woods to receive a hard finish, and the delicacy of their graining. A rough, brown piece of wood, labelled cinnamonora camphora, is a specimen of the tree from the roots of which the camphor of commerce is manufactured. There are also such articles as bamboo, rattan, and lacquer ware, sago-palm baskets, wooden water-pipe, palm-ropes, charcoal, seeds, sap, nuts, and sections of trees, great and small.



LARGEST LOAD OF LOGS EVER DRAWN BY ONE TEAM



MICHIGAN LOGGING CAMP

Brazil, the Argentine Republic, and Paraguay have remarkable collections of the woods used for ornamental purposes, together with barks, dyes, and medicinal herbs. The first has a large pavilion fashioned from small trunks and interlacing limbs, its main entrance in the form of an archway of Gothic architecture. Mahogany is a prominent feature, for this is one of the most valuable of Brazilian woods. Perhaps the finest of the cabinet woods are from the banks of the

The national department of agriculture and commerce sends a collective exhibit, comprising timber and planks, cabinet, ornamental, and fossil woods, barks and galls for tanning and dyeing, vegetable wax and resins, wood pulp for paper, and maps, plans, and illustrations of forest management. Colored pictures of various trees and flowers are shown, and upon the outer walls of the pavilion are depicted in graphic art wild scenes of the mountain forests.

Adjoining this, in the north-western corner of the hall, is the Indian exhibit, where a British trading corporation displays samples of teak flooring and wood paving, railway wheel blocks, and specimens of fabrics dyed with cutch. Elsewhere are planks and slabs of vermillion and

padouk, and a large door made of teak, the original of which is in the royal palace of Mandalay, Burmah. Upon it are scores of carved figures and architectural forms, representing the city, the king, queen, ministers, and the guardian spirit of the municipality, with other mythological characters.

Embedded among the individual and state exhibits are those of Siam and Trinidad, the latter with samples of rich red purple heart, of balsam, mangrove, guava, redwood, Spanish ash, and bamboos, in many sizes, together with specimens of what has been accomplished in several lines of manufacture. In Siam's collection, diagonally opposite from that of California, are more than 200 specimens of native woods, some of the smaller varieties in the form of baskets and rustic stands. The lordly teak is king of all, one solid slab, highly polished, being nine feet long, and six in breadth. Large sections of the taback and tamarind are also among the evidences of the forest wealth of Siam.



MODEL IN SILVER OF THE HORTICULTURAL BUILDING

WORLD'S FAIR MISCELLANY.—Adjacent to the Horticultural building are propagating houses and frames, where space is assigned to exhibitors for growing valuable plants such as will not bear transportation. Here also are illustrated modern improvements in construction; a Swiss inventor, for instance, erecting a green-house of glass bricks which he claims to be proof against cold, hail, and other destructive agencies, while others show their systems of steam heating, ventilation, etc. A considerable area is also used for replacing faded or injured specimens.

Both for heating and sprinkling ample provision was made. For the former purpose there were three boilers, each of 150 horse-power, and an elaborate system of engines, fans, and steam pipes, by which the temperature of the dome and the front curtains of the hall were adapted to the most delicate of tropical plants.

Near where the Midway plaisance joins Jackson park are the nurseries for the propagation of trees and berries. A large plat on the northern side of the avenue is planted in California oranges, lemons, figs, apricots, peaches, prunes, grapes, etc., and on the opposite side France shows her careful and scientific methods of raising pears, peaches, grapes, and other fruits. There is also a large collection of evergreens in this locality, with a Wisconsin cranberry bog, showing all the processes of flooding, draining, and

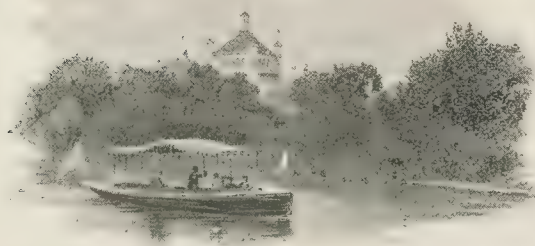
cultivating. Mexico has a section filled with characteristic plants; New York demonstrates how she would train grape vines, and a firm which manufactures nitrate of soda produces vigorous plants,

nourished, stimulated by this fertilizer side by side with others which, for want of it, appear as though sick unto death. In one corner of the nurseries is a mass of rank vegetation over which is a sign with the inscription, "What to Hit with the Hoe." Here are 125 varieties of weeds in actual growth, the exhibit being organized by a leading agricultural journal.

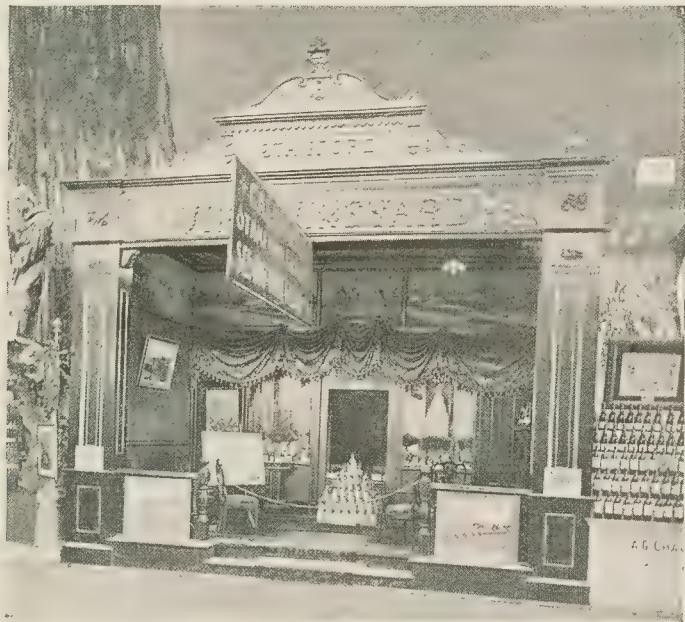
Among the curiosities of Horticultural hall are the American fly trap and the California pitcher plant. The leaves of the former are furnished with slender, comb-like teeth, the upper surface being set with slender hairs which are extremely sensitive. When touched they contract and draw the leaf together like a book, entrapping the fly and holding it fast as long as it is able to move; when the insect



IDAHO EXHIBIT



is dead and motionless, the leaf unfolds. The lower portion of the pitcher plant is set with long bristles, inclined downward, like a certain kind of patented mouse-trap. Thus the unwary insect falls into the water with which the pitcher is partially filled.



CALIFORNIA WINES

To foreign countries was assigned about one-third of the entire space in Horticultural hall, and so great was the interest aroused that they would have taken the entire area had they been permitted. The first exhibit was received in the winter of 1892 from New South Wales, whose wines also received in midwinter were frozen and spoiled, but promptly replaced by other specimens.

Except for wood-pulp the Forestry exhibits contain no completely manufactured articles, though there are many in various

stages of manufacture. In showing the structure and commercial value of woods, the usual method was to cut them into transverse, radial, and oblique sections, showing the heart and outer portions of the tree, leaving one-half of the specimen in its natural state, and polishing the remainder. There are also barks, gums, resins, and turpentine; lichens, mosses, and substances used for bedding and upholstering; specimens of herbs and roots having medicinal properties, and cork, both in rough sections, and partially manufactured. As a rule the states exhibit the wealth of their forests in their crude condition, while individuals display material in shapes which fall just short of manufactured products.

Not far from Machinery hall, Michigan has a typical loggers'

camp. Everything is built of logs, even to the large chimneys of the cabin. In and around the building are specimens of all the tools used by Michigan lumbermen, from the opening of the first camp down to the present time. The dining room is remarkably neat, as also are the bunks, with their frames made of tree limbs. Side-tracked near the model is a lumber car, piled high with huge logs. The load weighs nearly 290,000 pounds, contains more than 36,000 feet of lumber, and before being delivered to the railroad in Michigan, was drawn on a sleigh for a distance of a quarter of a mile by a single span of horses.

California's exhibit in the Forestry building is a forcible reminder of the wonders of forest life on the Pacific coast. Attention first centres in the *sequoia gigantea*, as is called the king of all the big trees which have made California famous. They attain a height of 300 to 350 feet, and are the tallest conifers in the world, averaging fully twenty-five feet in diameter.

New South Wales and Mexico each claim to have within their domain the largest tree in the world. The Australian giant, a species of fig tree, is 485 feet high. Through the president of her commission, Mexico asserted that in the state of Oaxaca there was a tree of the leguminous species 53 feet in diameter, and while its height had not been ascertained, it was undoubtedly the king of the vegetable world. It has been christened Santa Maria del Tule.

Besides having one of the largest displays in the building, Missouri contributed to the colonnade of trunks which surrounds it, specimens of yellow pine, oak, red oak, cypress, hickory, red gum, and ash. According to state authorities, the counties lying along the Mississippi river might have furnished much larger samples than those presented at the Fair. Nevertheless they are large enough to impress the visitor with the commercial value of timber trees which, not many years ago, were viewed simply as impediments to the agricultural advancement of the state.

Of the western states perhaps Minnesota has aroused more general interest on the subject of forestry than any other, realizing, as she does, the evils resulting from the denudation of her timber tracts. Here it is well understood that aside from increasing the beauties of the state, arboriculture equalizes the temperature and rainfall, breaks the force of wind and flood, supplies material for fuel and fencing, and furnishes an ultimate supply of timber which must become most valuable if the natural wealth of the state continues to be drained away.

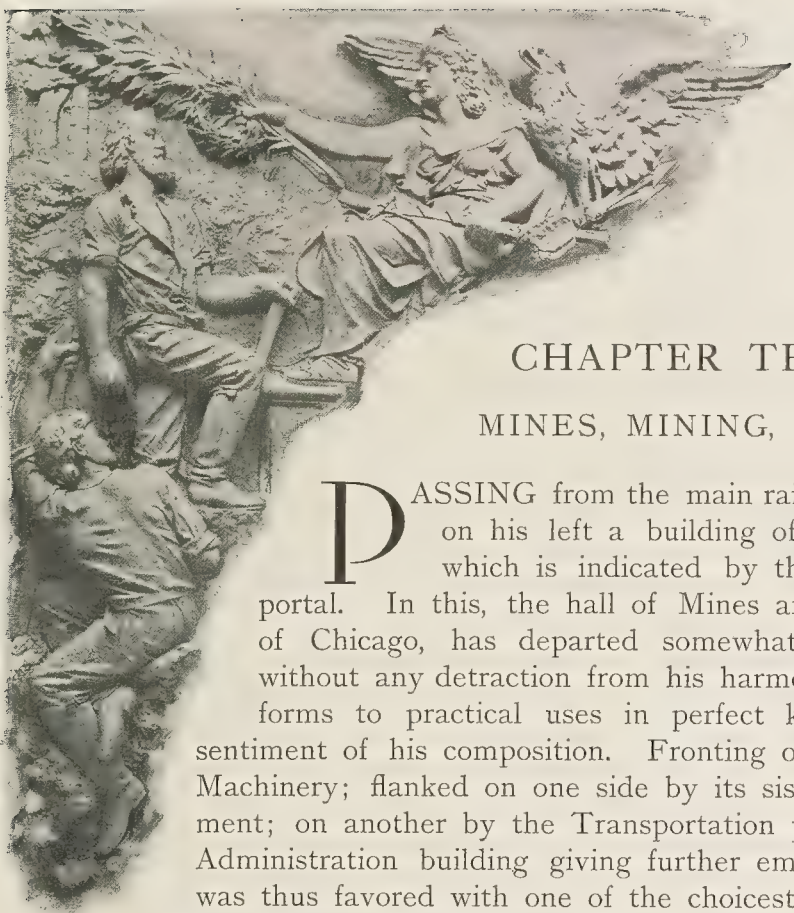


"POMONA"





A BIRD'S EYE VIEW



CHAPTER THE SIXTEENTH

MINES, MINING, AND METALLURGY

PASSING from the main railway terminus, the visitor observes on his left a building of elaborate design, the purpose of which is indicated by the single word inscribed above its portal. In this, the hall of Mines and Mining, its architect, S. S. Beman, of Chicago, has departed somewhat from conventional types, displaying, without any detracting from his harmony of plan, an adaptation of structural forms to practical uses in perfect keeping with what may be termed the sentiment of his composition. Fronting on the main court opposite the great hall of Machinery; flanked on one side by its sister edifice devoted to the Electrical department; on another by the Transportation pavilion, and with the graceful lines of the Administration building giving further emphasis to this imposing group, Mr Beman was thus favored with one of the choicest sites in the Exposition grounds, and to the best advantage has he improved his opportunity.

First of all it may be observed that in studying his design the artificer must prepare for the housing of a large and bulky display of ores and minerals, of mining and metallurgical machinery and appliances, many of them requiring a liberal proportion of floor room and height. Hence, in this building, and especially in its central nave, it was necessary to avoid, as far as possible, all columnar obstructions, leaving unencumbered the greatest available area for the reception of exhibits. Of the space at his disposal, including with galleries somewhat less than nine acres, a large portion was devoted to a nave 630 feet long, in its centre a circular court from which the main avenues radiate, and where is a design typical of mining industries. In all this spacious nave there are only sixteen pillars, eight on either side, and on which rests the system of cantilever trusses that support a lowered roof, fashioned largely of glass, and at its highest point nearly 100 feet from the floor. The aisles, which divide the building into four main sections, are similarly treated, and with their columns anchored against the inner rows. Thus is relieved the comparative depression of the curtain walls, whose height from ground to cornice is little more than sixty feet.

A further accentuation is given by the principal entrances, one in the centre of each of the four sides, those on the north and south 80 feet wide, with richly decorated cornices, and flanked by pilasters, on which rest banner staves, their flags imparting to the outline somewhat of a holiday appearance, and modifying the serious aspect of the design. Around all the entrances are monuments, designs, and figures in keeping with the exhibits contained within. At the corners are square pavilions, lighted by arched windows on either face, and with low domical roofs crowned with circular lanterns. Between these pavilions and the main portals are piazzas 25 feet wide, with coffered ceilings, and from which there is access to the interior at several points. From either side of the entrance-halls broad stairways lead to windowed galleries, 60 feet wide, and affording an additional floor space of more than 100,000 square feet. Thence, from numerous openings, the visitor may step forth into recessed balconies, from portions of which is an excellent view of the structures and grounds adjacent.



MINING EXHIBITS FROM THE GALLERY

In the elaboration of his design the architect has not adopted any special order of architecture, for in doing so he could not have given to his scheme an architectural expression in conformity with the character of the exhibits. The façades are of modern style; the roof planned somewhat after the fashion of those which cover the car-building sheds of the Pullman company. Elsewhere, and especially in the entablatures, are traces

of Italian detail, mingled with that of the French renaissance, while in the loggias and balconies the treatment savors of the Doric and the earlier Romanesque. Finally it may be said that, whether from an architectural or utilitarian point of view, the hall of Mines and Mining does not suffer by comparison with its more imposing neighbors.

As with the Fisheries and several other departments, this is the first of our great world's fairs at which mining has been placed on an equality with manufactures, agriculture, and all the more prominent industrial pursuits, and its exhibits ranked on a par with any, and housed in a building of their own. At the London and Paris expositions all such specimens were classed in a single group, to which was granted but a meagre allotment of space; and even at our own Centennial Exposition they were pushed aside into an annex of the industrial edifice. Here, however, due prominence is given to an industry which in value of production ranks third among those of the United States, many of its branches, before incorporated in other divisions, for the first time receiving in their proper place a fitting and adequate representation.

Says the chief of this department, referring to the scope and character of the exhibits: "They will cover the entire range of the mineral kingdom. They will include minerals of every kind, ores, native metals, gems, and crystals; geological specimens; coal, coke, petroleum, natural gas, building stones, and quarry products; graphite, limestone, cement, and artificial stone; salts, sulphur, fertilizers, and mineral waters; the long catalogue of iron and steel, and of tin, and the new metal, aluminium; the extraction of gold, silver, and lead by various methods; mining machinery, tools, and appliances; literature, models, and reproductions. When we consider the wealth represented by the quarries of New York and the New England states, the coal and iron of the Alleghanies, the phosphates of Florida and the Gulf, the oil and gas of Pennsylvania and Ohio, the copper of Lake Superior and the tin of the Black hills, the silver and lead of the Rocky mountains and the gold of California; with the immense manufacturing interests connected with the production and manipulation of our country's vast mineral wealth, remembering that there come into competition with her all countries and quarters of the globe, the varied and exceptional character of the mines and mining display will be appreciated."

On entering the hall which contains these exhibits, the first question the visitor asks himself is "How did they get here? How were these mammoth specimens collected and transported from every quarter to be placed in congruous and symmetrical groups under the roof of a single edifice?" Perhaps in no time or place but the present could they have been got together; for years of persistent solicitation and careful planning were required before the more bulky articles were rolled



MODEL OF COAL MINING MACHINERY



INTERIOR OF MINING BUILDING



PENNSYLVANIA BRICK AND TILING

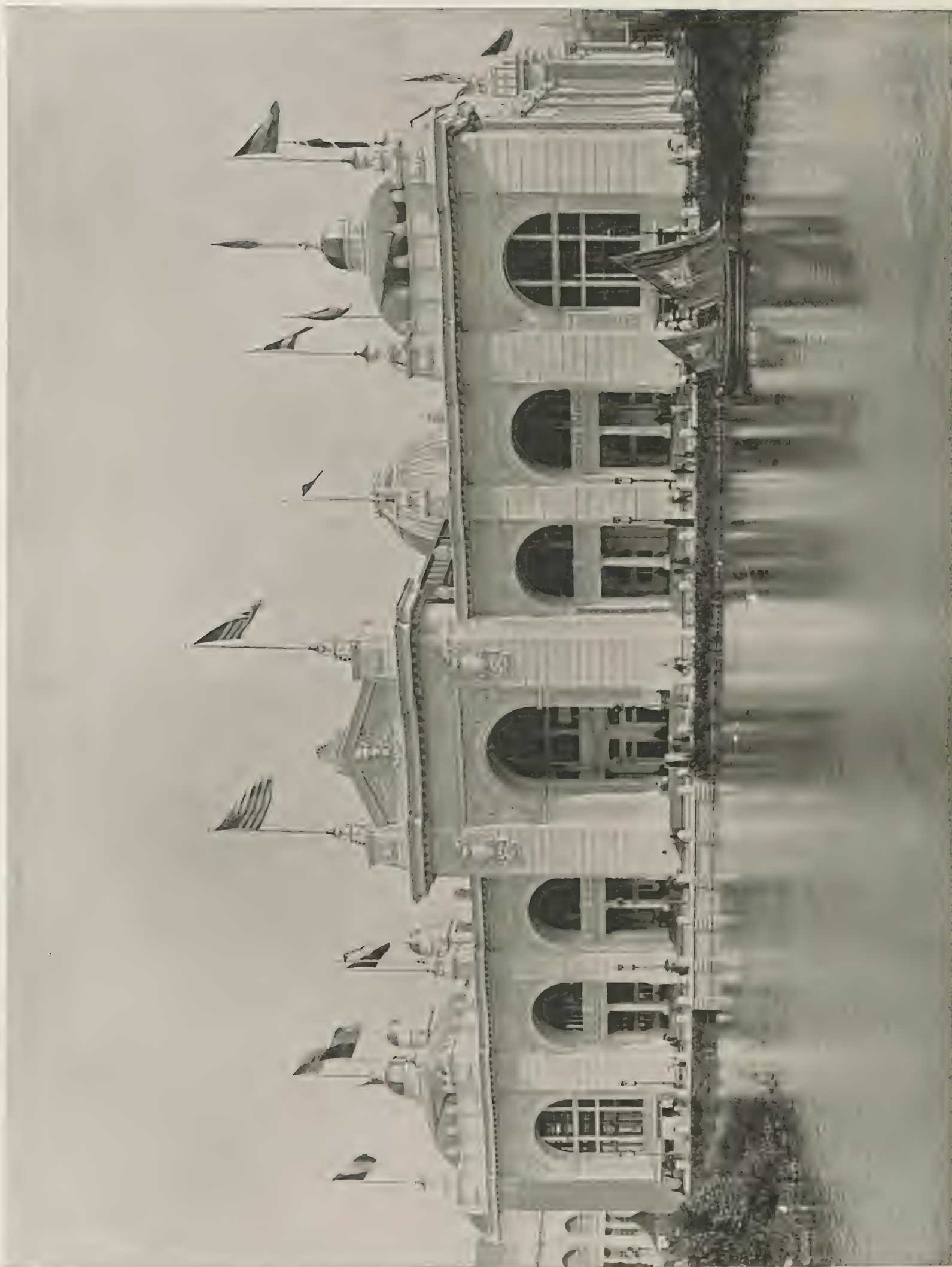
on cars to the principal entrance way, to be lifted by cranes and moved on trucks into position. From the spacious central nave, sometimes termed Bullion boulevard, extend eastward the state and territorial pavilions or structural façades in metals or minerals, beyond which is the mining machinery; while to the west our foreign friends show what their several countries can produce. Among United States exhibits Montana's silver statue, Pennsylvania's needle of anthracite coal, and the geological obelisk of the empire state attract much attention. Among those of other lands may here be mentioned the elaborate collections of Germany, Mexico,



EXHIBIT OF THE EMPIRE STATE

Canada, and New South Wales, and the diamonds which in the spectators' presence are washed by Kaffirs out of the blue earth imported from Kimberley mines.

On the gallery floor the largest of the individual exhibits are those of the Standard Oil company, and the Frick Coke company, the former displaying the several methods used in the production and distribution of oil, and the latter a model of their plant. Of scientific interest are the metallurgical displays arranged by the chief of the Mining department, and the collections of the Ward Natural Science establishment. In a series of courts are arranged in related groups all mineral substances of industrial, economic, or scientific value, with an assaying department in actual operation. Nor should mention be omitted of the library, catalogued for public use, and containing histories and statistics of mines and mining districts, with numerous charts and diagrams, together with maps and models illustrating the geological formation and distribution of mineral veins, and the modes by which they are worked. To the mining engineer or surveyor the collection is especially valuable, for here are treatises on every branch of his profession, including among others the location of shafts



MINING BUILDING. NORTH FRONT



PLUMBAGO, NEW YORK SECTION

and tunnels, their sinking or boring and timbering, the sloping and hoisting of ore, and the drainage, lighting, and ventilation of mines. Finally, the visitor may compare the present with ancient methods, for here are some of the earliest apparatus used in mining and metallurgy, either as originals or reproductions.

Coal and iron are treated in broad lines; for in the United States these industries represent the investment of hundreds of millions of capital and afford employment to hundreds of thousands of men. Of bituminous coal the annual yield exceeds 100,000,000 tons; of anthracite nearly half as much, and of pig iron about 10,000,000 tons; the total value of their output, the two first as delivered at the mines being estimated at more than \$300,000,000. Next in order of value, or very nearly so, are silver, building stones, copper, lime, gold, petroleum, natural gas, lead, and zinc, these and other metals and minerals increasing the total production to about \$650,000,000 a year. In the exhibits contained in the Mining hall, quality rather than quantity is the feature of the display; and here the visitor may learn more in this connection than years of travel could teach him. In the coal collections for instance, are not only the varieties produced in different regions, but with many of the specimens are chemical analyses, and the results of tests whereby have been demonstrated their economic value and adaptability to special uses, with geological

and other maps and drawings showing stratification, extent, locality, accessibility, and other valuable data. And so with iron and other products, all the groups being arranged and illustrated with special reference to the industries which they represent.

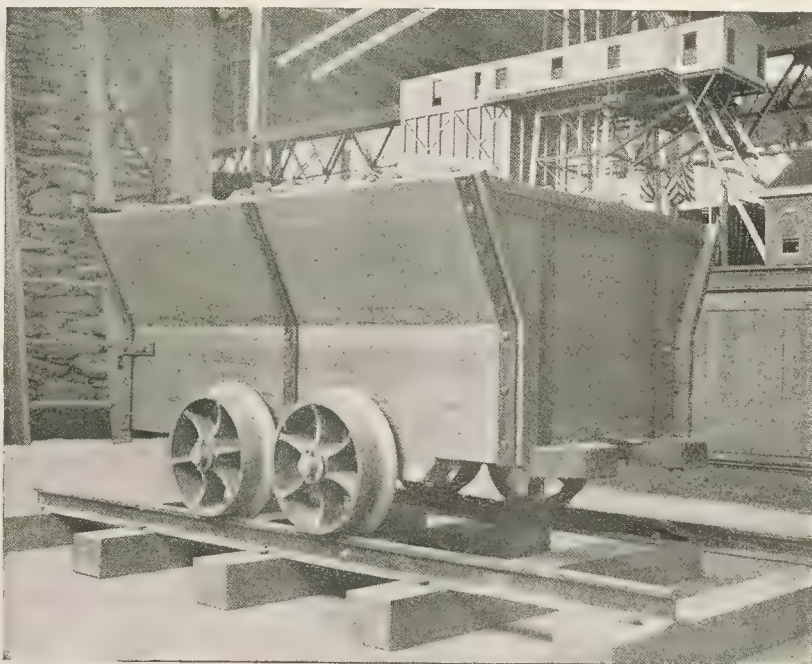
Near the northern portal of the hall, flanked on either side by the pavilions of France and Pennsylvania, is a lofty monument fashioned of cubes, which gradually decrease in size almost to a point. Those at the base are of massive proportions, and on several of them are inscribed the words anthracite, limestone, natural gas, petroleum, iron ore, and granite. Then come salt and other minerals produced in the United States, the precious metals seeming to have no place in the column. In these cubes are represented the proportionate bulk of all the minerals which come from the mines and quarries of this country during one second of time, asbestos forming its tip, gold ore second, and silver ore only a few removes from the top.

Within the entrance of Pennsylvania's pavilion are displayed her petroleum and petroleum products in hundreds of glass bottles contained in neatly finished show-cases. Facing them is a large relief map of the state, representing the location of her principal coal and iron mines, her oil and natural gas deposits, blast furnaces, pipe systems, and railroads. In a small pavilion are shown the various uses of slate, as for pillars, roofing, walls, and black-boards. On the western side are exhibited in the form of truncated pyramids, grouped in rectangular shape, all the varieties of anthracite, with commercial samples and analyses, while at the corners of the rectangle are samples of bituminous coal. A colored drawing illustrates the manufacture of zinc oxide and spiegeleisen, the latter largely used for the manufacture of Bessemer steel. In bricks and other samples, crude and burned, are shown the many varieties of fire clay found in Pennsylvania, and next to these are tile clays in every form. There are also more than 100

specimens of building stones, with glass sands, the mixtures used for various kinds of glass, and the finished product. Soapstone, nickel, manganese, iron ores, and the several stages in the manufacture of iron, with the charcoal, anthracite, bituminous coal, and coke used for such purposes, are also on exposition.

An interesting exhibit is a complete working model of a coal mine, with engines and the work they do, from hauling coal up the incline until it is dumped into the screens and there assorted into sizes and loaded into railroad cars. Near by is a primitive iron furnace, of a pattern more than 1,000 years old, and grouped about it are rude implements such as Tubal Cain might have used. On the walls are photographs, charts, and maps of geological and mineralogical surveys, with relief maps and other illustrations.

But the most attractive feature is in the central court of the Mining hall, where is the shaft or so-called needle of anthracite already mentioned. This trophy is fashioned of solid blocks of that mineral, extracted from



COAL CAR FOR MINING

the Mammoth mine of the Lehigh Valley Coal company. It is more than 50 feet high, weighs nearly 100 tons, and to mine and place it in position was the task of many weeks, involving an outlay of several thousand dollars. The entire collection from Pennsylvania is gathered and arranged as a utilitarian rather than an ornamental display, and shows to excellent advantage her rich and manifold resources.

The exhibits of the empire state are also of a substantial character, with no attempt at ornamentation except for the pavilion which contains them, and a pagoda of terra cotta in one of its corners. The former is in the shape of a rectangular colonnade, the entablature resting on Ionic arches springing from pillars of uniform design, and the corners surmounted with handsome balustrades. The cornices and frieze are decorated with sculptured tablets, and the spandrels between the arches are ornamented with representations in relief of



A MODEL DISPLAY

mining scenes and implements. In front is an obelisk constructed of rocks in the order of geological succession, the device of the geologist James Hall. Here it may be mentioned that, apart from local collections, this is the only complete exposition that New York has ever attempted of her geological formation and mineral resources, though in this state is found the keynote to the geology of a vast adjacent region.

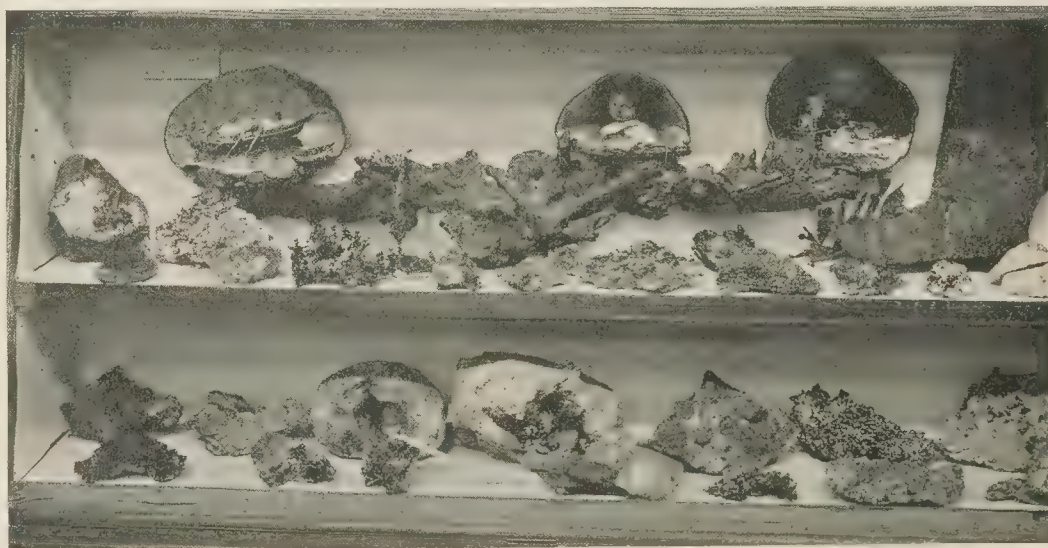
Among the exhibits are samples of all building, ornamental, and other stones of commercial value, of which the state possesses an abundant store. There are likewise specimens of the solid crystalline salt deposits peculiar to her soil, with clays, gypsum, sands, and shale, the first including kaolin, and displayed in raw and manufactured forms, together with mineral paints, iron ores, and petroleum. A feature in the collection is the beautiful specimens of quartz and fluorite, and on the gallery floor is a large

assortment of precious stones and minerals contributed by a New York jewelry firm.

Adjoining the New York section on the east is the New Jersey pavilion, the greater portion of which is devoted to an exposition of her geology, illustrated by a large relief map. Along the walls are cabinet specimens of ores, building stones, and potters' clay, in the last of which the state is especially rich. Her production of zinc is somewhat remarkable; and here the information is conveyed that of the 1,000,000 tons of ore produced in the United States since 1873, 719,000 were contributed by New Jersey.

Either in the western galleries among the metallurgical groups, or in the eastern galleries among the specimens of building stone, all the New England states are represented with the exception of Rhode Island. From the Colby university of Waterville, Maine; from the Portland society of natural history, and various private sources, are collections of minerals and gems, a quarry company contributing a large urn of polished granite and a variety of smaller specimens. Harvard college sends to the Massachusetts section many rare fossils, large slabs of stone showing the foot-prints of some mammoth of the antideluvian era. Granite and marble, gneiss and hornblende, corundum, emery, and graphite, with an abundance of ores and gems, virtually complete the collection of the old Bay state.

New Hampshire, Vermont, and Connecticut display their granites and marbles in the eastern galleries. In the New Hampshire collection are many specimens of mica, and pillars and a massive table are constructed of the stone for which that state is famous. The granites of Connecticut, principally gray and red, are also the prominent feature of her section. Vermont, while showing several beautiful varieties of granite, upholds her reputation as the producer of some of the best marbles from the quarries of the United States, the specimens being displayed



SECTION OF MINERAL CABINET

in a circular portico of Grecian architecture. Many of the cases within contain cubes of the best known American varieties, and the famous marble quarries of Rutland contribute largely to the general effect.

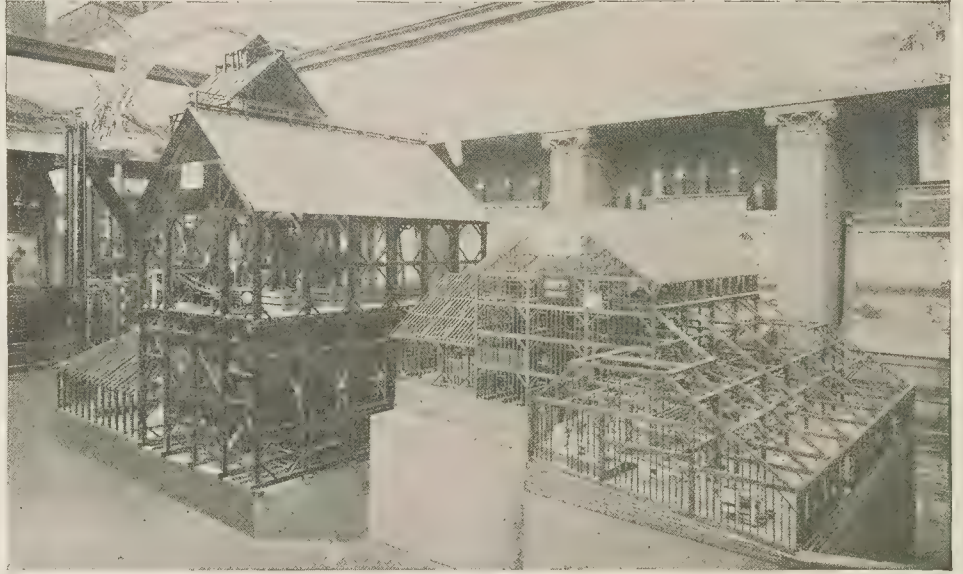
One of the most interesting and unique of the scores of pavilion elevations in the Mining hall is that of Kentucky, in the background of which is depicted the entrance to her mammoth cave, while beneath it is reproduced a section of the cave, to which a trap-door affords access. The façade is a temple-like structure



GENERAL VIEW DEPARTMENT OF MINING

of Gothic architecture, and, together with the wide open archway in the centre, is built of cannel coal, its effect increased by contrast with the white marble edifice of the empire state. Its plan was suggested by the portal of the Virginia Military institute in Stonewall Jackson's native town. While consisting largely of coal, as might be expected from a region with 14,000 square miles of bituminous coal deposits, and with a yearly output of more than 3,000,000 tons, the exhibits of Kentucky are as varied as her resources, and include marble and other valuable stones, tile-clay, copper, iron, gold, and silver, all displayed as minerals, ores, or metals to the best advantage.

Ohio's section is enclosed by a handsome colonnade, constructed entirely of minerals found within her borders, and intended to present in picturesque form her resources in that direction. One of the passage-ways is fashioned of tiles, and extending over the entire length of the floor space at the northern end are alcoves containing specimens of quartz. In show-cases are mining and mineral samples, and in the centre are models illustrating the manufacture of table salt and the machinery used for pumping oil from Lima's productive wells. In the galleries Ohio is well represented in the metallurgical exhibits organized by Frederick J. V. Skiff, the chief of the Mining department, and here also are several collections from her university and colleges of agriculture and the mechanic arts.



MODEL OF MICHIGAN MINING BUILDING

Representing as they do one of the most prolific districts in the production of building stone, the exhibits of Indiana, both in the construction of her pavilion and its contents, are somewhat of a uniform character. The four granite pillars which support the entrance harmonize in coloring with the whitish grey of the limestone, the latter a prominent factor in the mineral wealth of the state. The quarries at Bedford are especially noted, and thence were gathered the bulk of the limestone specimens ranged along the centre of the section. Opposite are large blocks of coal, for which Indiana is famed, both as to quantity and quality of output. Elsewhere are cabinet specimens of building stone, and samples of petroleum oil, brick, tiling, and other clay products, while near the western entrance to the Mining hall is a stately pillar of oolitic limestone from Bedford deposits.

Michigan occupies a place of honor, fronting on the central court, and with the largest space allotted to any of the state exhibits. Among the materials used for her pavilion are specimens of building and ornamental stones, with other minerals taken from Michigan mines and quarries. The archway is of native sandstone, its dome-like interior lined with copper, on which are displayed the mineral products of the state fashioned in the form of shields, with the coat of arms on medallions, and above all an allegorical group representing two miners whom the presiding genius of that industry is crowning with wreaths of laurel.



A COPPER MONSTER

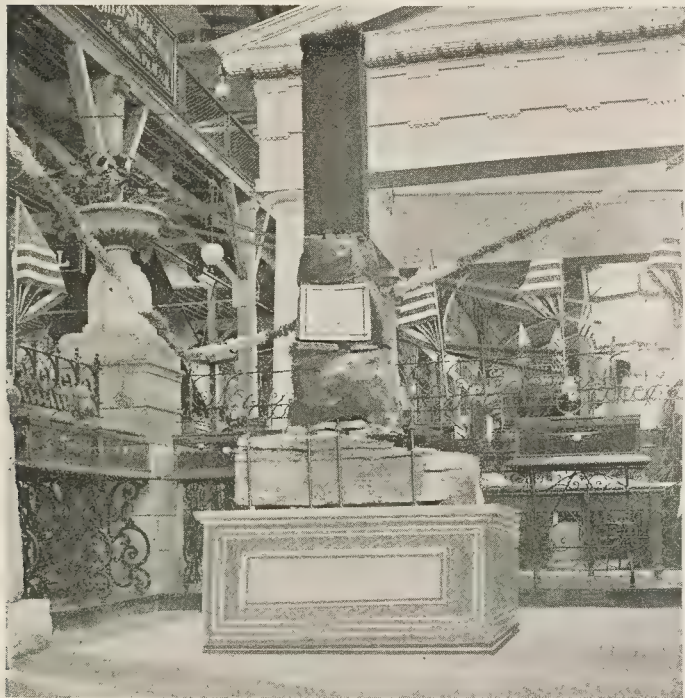
Fronting on the central nave is a large diagram showing a cross-section of a mine operated by the Cleveland Cliffs Iron company, and representing its geological formations, with the system of shafts sunk to three successive levels before the ore body is reached. On two of the interior walls are pictures of the more prominent mines in the upper peninsula, as the Pittsburg, Barnum, and Salisbury, around which are heaps of timbers and snow-covered piles of ore. The famous Calumet and Hecla mines, and the stone quarries of Marquette, are also reproduced in graphic art; and among scenic views are those of Lake Angeline

before its waters were drawn off, and of Todd's harbor and Isle Royal. One of the exhibiting companies shows the levels of its mine in sheets of glass on which are indicated the locations of drifts and tunnels, while elsewhere are models of machinery, mills, and reduction works.

Michigan's display of minerals is both interesting and instructive; including specimens of the richest iron ore found within the state. There are samples of gold ore found near Ishpeming, assaying \$10,000 to the ton,

with silver ores, marble of different kinds and colors, verde, antique, and serpentine, and granite and whetstones. These specimens are for the most part taken from private collections, as are also graphite, fire and common clay, fire sand, coal, amethyst, agate, and chlorastrolites, the last a beautiful mineral, and found only in Spain and on Isle Royal in Michigan. Among other samples here displayed in profusion may be mentioned red analcimes, abophylites, preahnites, dalholites, stilbites, dolomites, and calcites. Then there are pipe ores, kidney ores, needle iron ore, grape ores, epidotes, and calcite crystals, containing native copper, yet indeed representing but a tithe of the more valuable and useful portion of the collection.

But copper is the main feature in the Michigan section, and in truth the display is a generous one, including native copper, copper ingots, bars, sheets, cakes, and wires; rag, nail and fan copper; ores, conglomerates, and amygdaloids; battery and tailing samples, and copper in what other forms soever it is found or fashioned. The largest mass is of native copper, weighing 8,500 pounds, with others almost as bulky, composed of the richest of ores and conglomerates. In the centre of the pavilion are two mounds of copper, one constructed of wire, at the base of which are sections welded by an electrical process whereby wires can be produced of indefinite length.



FROM THE FAMOUS PIPESTONE QUARRIES

Among the more curious exhibits are prehistoric tools found in the mines, fashioned of native copper, and in the form of knives, spear and arrow heads, adzes, and hammers. These are among the state contributions; and no one can tell how they were made, for the metal is hardened and tempered by a process which modern scientists and mechanics have failed as yet to discover. As to this process it can only be said that thousands of inventors have tried in vain to reproduce it, and that to the aborigines of the Lake Superior region was known what is now a lost art, whereby weapons and tools were made such as cannot be duplicated by the most improved of modern methods. Says the official in charge of this exhibit: "It is claimed by several that tempered copper is now being placed on the market; but if the art is ever to be discovered, it has not been achieved so far. I have heard of men who have seen weapons or tools of the aborigines that would turn the edge of a steel chisel or dull a file."

The state which contains the home of the Fair reserves her strength for the machinery department in the Mining hall, and is mentioned in that connection. In Wisconsin's collection are fully illustrated her abundant mineral resources.

Shafts of polished red marble support the arch above the entrance way; at the corners are monoliths of sandstone, and within is a temple-like structure, its dome upheld by fluted columns with Doric capitals. The floor is of black and white tiling, and the materials for the outside walls were furnished from Bayfield quarries. In the centre of the pavilion is a pagoda, at the corners of which are bars of lead and piles of iron, zinc, and galena ores. In pyramids and other forms are all the economic minerals and metals of Wisconsin, in raw or manufactured forms, including marble and granite; bricks, tiles, and terra cotta; jasper and serpentine; iron, copper, zinc, and lead; brown hematite of ochre, mineral paints, and the sands that are used for the making of glass. From Milwaukee are specimens of the so-called Wisconsin pearls, and from not a few of the exhibitors are entire cabinets of specimens, for many counties have contributed to the display.

Minnesota's home in the Mining hall is east of the Ohio section, her booth partially enclosed by a bronze fence of scroll-work, and the entrance-way of building stone from her principal quarries. Within is a remarkable display for a state that has but recently attempted mining on any considerable scale. Her principal exhibits are of iron, large contributions coming from the region tributary to Duluth, and including a great variety of specimens. About thirty companies are represented, and the samples shown by each contain not less than 63 per cent of metal, while several show nearly 70 per cent, a remarkable average considering the extent of territory from which they were taken.

Of iron ores there are many exhibitors, including a carefully selected group of specimens. Of building stones there is a special contribution containing 100 varieties, with samples of bricks and the clays from which they were made. From Duluth is a fine specimen



ORES OF WISCONSIN

of Lake Superior amethyst weighing 300 pounds. A group of jasper shows the highly polished quartz; another is in the rough, and a third consists of carved figures from stone of a reddish hue. From Sioux valley is also a handsome shaft of jasper polished by hand. Granite is well represented, especially in a pillar and shaft of this material, the latter of the speckled variety from Rockville. There is slate from Cloquet, brown stone from Duluth, and other varieties from various parts of the state. A unique structure is in the form of a mound, its base of Indian pipestone, upon which is a layer of jasper, then several feet of earth, with the greensward for a covering. The lower portion of the mound was quarried from the red pipestone quarries on the national reservation in Minnesota, near Pipe Stone City, and said to be the only quarry of its kind in the world. Since time immemorial the American aborigines have made of this substance for their peace-pipes which Longfellow has described in his *Hiawatha*.

Among other features of interest is a model of the Chandler mine at Ely, showing the shaft houses, tools, and mining apparatus, as well as the geographical formation and the different levels, with the process of mining, hoisting, and timbering, and with miners carrying lanterns on their heads. Arranged along the inner walls are charts illustrating the geological survey of the state, while a large map shows the underground plan of the Minnesota mines at Soudon.

Beneath the stairway at the southern end of the Mining hall are the coal pillars of the Iowa pavilion, to which an ornate appearance is given by the judicious use of colored clays and sands. Within are mounds of iron, lead, and zinc, a miniature grotto constructed of material gathered from the caves of Dubuque county, and the display of a Centerville coal company, consisting of models of its works and cars, installed upon a platform of coal. There is also shown the interior of a coal mine, with full-sized figures of miners at work, and a truck filled with coal on the track ready to be hauled to the surface. The depth is only twenty-five feet, but by an ingenious device appearing as though it were several hundred feet. The mouth of the pit, over which are the words Iowa Black Diamond Hollow, is surrounded with solid blocks of coal. Adjoining the pavilion proper are cabinets of economic minerals, and a small section in which are shown by a marble company specimens of its stone in raw and manufactured forms.

To Missouri was assigned one of the four sections around the central court, where also are the exhibits of Michigan, Germany, and Great Britain. Her tasteful pavilion, with its handsome portal and colonnade, its decorated frieze and balustrade, is composed almost entirely of materials furnished by the state. The base is of granite from the syenite quarries of southeastern Missouri, the walls of brick from St Louis county, and the pillars, capitals, and frieze are of terra cotta. At the principal entrance-way are panels of onyx, and the coat of arms above it is surmounted by an eagle, with garlands depending from the shoulders of cupids.

Within this structure are worthily represented the resources of a state which in 1892 produced more than 3,000,000 tons of coal, 131,000 tons of iron ore, of zinc ore almost as much, and 32,000 tons of lead; her yield of these metals for the year being estimated at \$9,100,000, and the entire output up to that date at \$178,000,000. On tables and in glass-covered show-cases of polished oak are countless labelled specimens, with photographs and models indicating mineral localities and features, and with mineral production and distribution displayed in chart and diagram form. In the centre of the pavilion is a large relief map showing the areas and locations of all the principal deposits of economic minerals. The value of the entire display is further increased by its



SOUTHWESTERN ZINC

methodical arrangement, with inscriptions and labels for the various groups of products, and for each of the specimens of which the groups are composed.

While coal, iron, lead, and zinc form the bulk of the display, there are numerous specimens of other metals and minerals, including copper and silver ores; blendes of various kinds; calcites, calamites, dolomites,



SECTION OF MISSOURI PAVILION

and siegenites; ochres, glass-sand, clays, and bricks; sandstone, limestone, marble, and granite. Zinc is a special feature in the collection, as befits a state which produces more than one-half of the entire output of the United States. Some of the specimens are remarkable for range and brilliance of coloring; their shades varying, from black to a lightish yellow, while colorless crystals are arranged in tasteful groupings. The mineral is displayed in every shape, beginning with the crude ore as it comes from the mine, showing it at each successive stage up to the completed product in all its commercial forms. Lead is similarly treated, and near a table on which is a 1650-pound mass of zinc ore is a group of almost perfect cubes of galena weighing 500 pounds, and almost entirely of pure lead from the Joplin mines. In the centre of this section is a pedestal of solid metal formed of specimens from various smelting works throughout the state. At the southeast corner

is a pyramid of ore built of specimens ranging from a few pounds to several tons. From Greenfield quarries comes a handsome marble altar, and from St Louis county, a sample of nickel sulphide, of special interest to mineralogists.

Arkansas, Missouri's geographical neighbor, occupies only a few square feet of space in the extreme southwestern corner of the hall, among the exhibits of Latin-American republics. There the state is represented by a small collection of minerals, consisting mainly of carbonates of zinc.

Upon the frieze of South Dakota's tasteful pavilion is the inscription: "First in gold mining machinery, first in new mines, and second in gold." In support of this claim are exhibited some remarkable specimens of gold ore, though perhaps more noteworthy is the



MISSOURI LEAD

collection of tin ores from Harney peak. Coal is but feebly represented; for the extensive deposits of South Dakota have as yet been little utilized. In the rear of this section are two life-size figures carved in sandstone, one of a pioneer prospector, and the other of a prosperous, well-dressed citizen of the present day. Among the attractions are also petrified woods from the neighborhood of Sioux Falls, and a tower of Portland cement from a Yankton manufacturer.

The Kansas section in the north of the hall corresponds to that of Iowa in the south, but is of smaller extent. Briefly, lead and zinc ores, metallic lead and zinc, rock salt and gypsum comprise the exhibit, among which are several fine specimens of galena lead, displayed at the entrance-way. Among the collective exhibits in the east gallery are also samples of Kansas cement, and of golden ochre from the Saline river.

The most striking feature in the section allotted to West Virginia is the exhibits of coal, specimens of which are seen at every hand and in all sizes and shapes. This is as it should be, since, both in actual production and in deposits still undeveloped, the state occupies a foremost rank. As is also evident from this display one of the most prominent industries is the manufacture of coke, while petroleum, both crude and refined, calls attention to another source of wealth. Building stones, fire clays, hydraulic limestone, and glass sand are here on exposition, with a refuse substance from a glass factory known as mineral wool which, in appearance and fire-proof qualities, is little inferior to asbestos. In the picturesque mountains of West Virginia are numerous mineral springs whose waters possess valuable medicinal properties, and of these there are a few samples among the more substantial collections.

With the exception of West Virginia, the exhibits of the southern states are installed in the northeastern section of the hall, adjoining the department of machinery. North Carolina has the most elaborate display, and along one side of it are groups of limestone, white, blue, gray, and mottled marble, gray and pink granite, and gray and brown sandstone. In cases arranged along the section walls are many specimens of gold, both free and in the ore, with smaller collections of iron, tin, copper, silver, and coal. Sapphires, garnets, emeralds, smoky quartz, and other gems and crystals are shown, together with such useful products as kaolin, fire-clay, graphite, and talc, the last especially valuable in the manufacture of pencils. In crystalline and silicious forms are numerous



COAL FROM WEST VIRGINIA

samples of corundum, which serves as the basis of many preparations used by dentists and opticians, and also by workers in metal, for grinding, abrading, and polishing their goods. The mica deposits of North Carolina furnish an interesting collection, and the exhibit is diversified by a number of large photographs displaying various localities which nature has enriched with mineral deposits.

In Virginia's section, one of the most attractive features is the picturesque scenery along the line of the Chesapeake and Ohio railway, depicted in the background. Among the exhibits proper the most remarkable are two large masses of iron ore and coal, the former of which is the nearest approach to steel that nature has made, while the latter is a coking and almost smokeless variety, and combines more desirable qualities than



any that have yet been mined. In the North Carolina collection are specimens of zinc, lead, and tin ores, the ores from which mineral paint is made, and granite, slate, and other building and ornamental stones.

Between the New Jersey and Minnesota pavilions a small section is jointly occupied by Louisiana and Tennessee. The latter presents a few specimens of iron, coal, building stones, and the clays used in the manufacture of bricks and tilings. Louisiana occupies the greater part of the space, and of special interest are the exhibits of chalk kaolin, and the clays used by the potter and the maker of imitation meerschaum pipes. There are also a few samples of iron, gold, and silver ores, of sandstones and whetstones, and of soda and potash; but the most striking exhibits are of fine, coarse, and rock salt, one of them representing a figure of Lot's wife standing in the foreground.

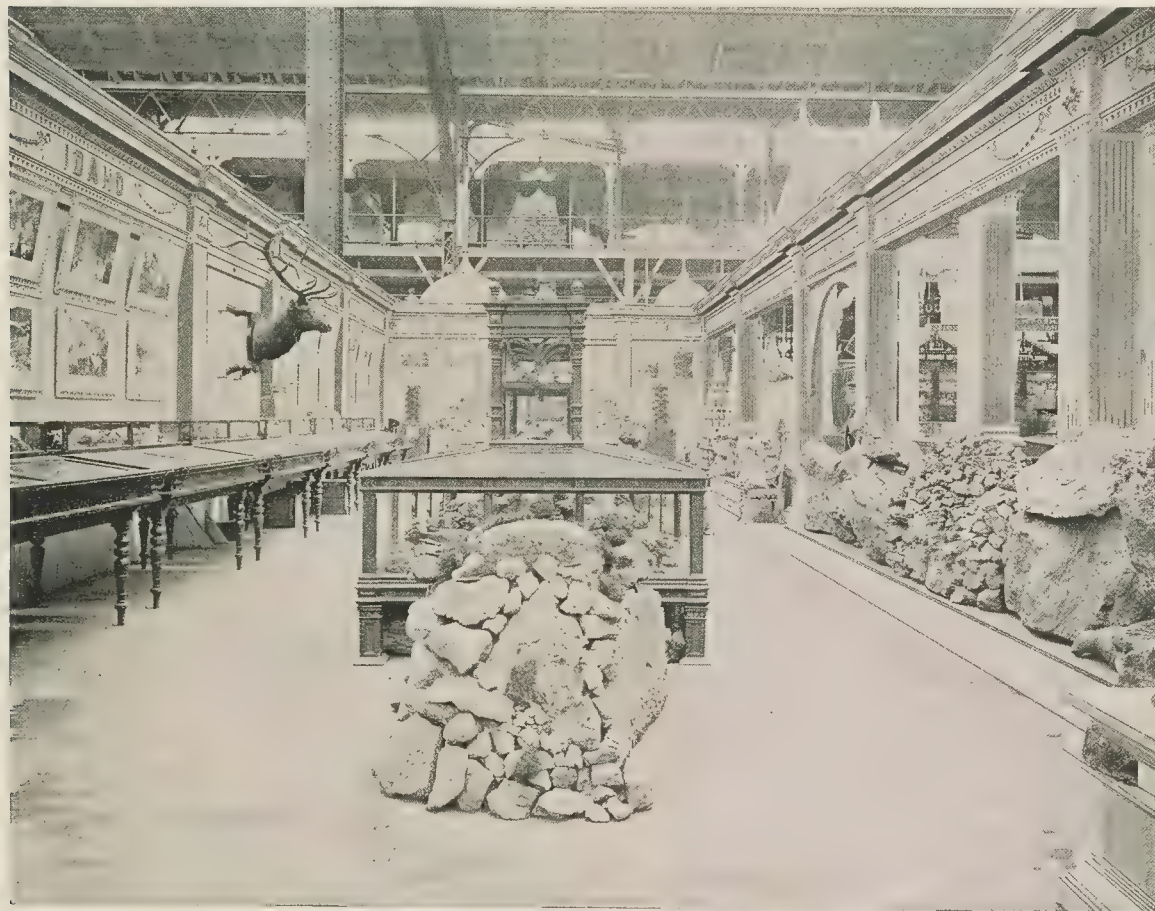
Except for a shaft of semi-bituminous coal at one of the western approaches to the Mining hall, the building by a manufacturer of mining machinery, Maryland is without representation in this department. South Carolina and Florida find expression in the eastern galleries, especially in their lavish display of phosphates, the one from the Palmetto state being mainly contributed by mining and manufacturing companies of Charleston. Among them is crude phosphate rock, mined both from the river beds and the dry soil, together with strange forms of fossil life. From Florida are also samples of phosphates, both in its crude state and prepared as a fertilizer, the exhibit being arranged in a frame of native woods which shows the geographical outlines of the state.

Before describing the exhibits of the Pacific slope, whence comes our main supply of the precious metals, a few remarks may be of interest as to the relative yield of gold and silver, and the conditions evolved thereby. Of the total output of the United States, amounting for the century ending with 1892, to nearly \$2,000,000,000 in gold and \$1,200,000,000 in silver, less than one per cent was produced between 1792 and 1847. Then came the discovery of Marshall, who was about to throw away as iron pyrites a handful of what proved to be scales and nuggets of gold, picked up near the historic saw-mill in Coloma valley. In the single year of 1849 more gold was taken from the earth than during the half century which preceded it, production gradually increasing until in 1853 it reached its maximum value of \$65,000,000, gradually diminishing to less than \$40,000,000 in 1862.

Meanwhile the Comstock lode had revealed its treasures, and from an average of less than 40,000 ounces for many previous years, the total output of silver rose to 6,600,000 ounces in 1863, gaining in volume, though with many fluctuations, until for 1892 it was estimated at 58,000,000 ounces, for the waning yield of Nevada mines had been more than compensated by the product of Colorado, Arizona, Montana, Idaho, Wyoming, and other Pacific slope states. This was attended with a corresponding shrinkage in value, the price of silver in New York and London falling from \$1.14 to 87 cents an ounce, or a decline of some 24 per cent for the decade ending with 1892, and with a still further depreciation in the following year. Between 1849 and 1860 the production of gold in relation to silver was in the ratio of more than fifty to one in actual weight. Thenceforth these conditions were gradually changed until, for the ten years ending with 1892, there were produced about twenty-five ounces of silver to one of gold, while for the last of these years the proportion was thirty-six to one. Here is the key-note to the silver question; for the precious metals are merely commodities, and like all other commodities, are subject to the inexorable laws of supply and demand. To place a fictitious value on silver is no more practicable than to place a fictitious value on coal or iron, on wheat or pork, and all such efforts



GOLD, SILVER, COPPER, AND LEAD



WITHIN IDAHO'S PAVILION

can only result in making the United States the dumping ground for the loose silver of the world. Such, at least, are the teachings of political economy, a science the merest elements of which it would seem that many of our law-makers have yet to learn.

Though with a vastly diminished yield as compared with earlier years, California still occupies the foremost rank as a gold-producing state, her output averaging from \$12,000,000 to \$13,000,000, or more than one-third of the present production of the United States, while of the total yield, since 1848, more than two-thirds must be accredited to the golden state. Of silver her annual product is less than \$1,000,000, and has never exceeded that amount. Of quicksilver a considerable amount is pro-

duced, the New Almaden mine alone contributing since 1850 more than 70,000,000 pounds. Iron is widely distributed; but can be imported at rates that almost prohibit local development. It was not until 1880 that the first smelting works in California were erected at Clipper gap in Placer county, with a capacity of 15,000



SPECIMENS OF GOLD AND SILVER ORE, IDAHO EXHIBIT

tons a year. Coal, though abundant, is for the most part in narrow seams, of inferior quality, and in localities difficult of access, the only productive veins of importance being near Mount Diablo, within a few miles of San Francisco bay. Of petroleum 8,000,000 gallons were obtained in 1884, and since that date a much larger quantity. The largest works are in Ventura county, whence the crude oil is conveyed in iron pipes to a shipping point on the coast. Asphaltum, formed by the evaporation of the volatile portion of the oil, is also plentiful in several of the southern counties.

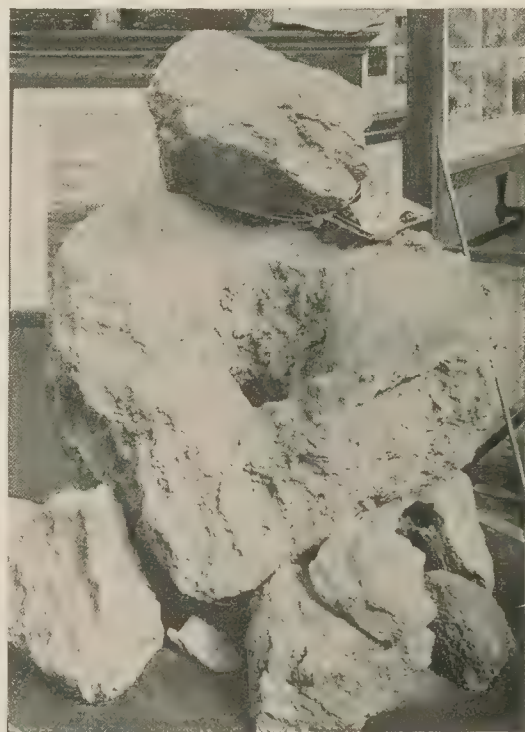
Of copper there is enough to supply the demands of the world, but with less than \$100,000 worth annually taken from its native gangue. Borax is largely produced in San Bernardino and Inyo counties, from a tract 10,000 acres in extent. In Lake county there are also valuable deposits, together with a sulphur bank, on the eastern shore of Clear lake, where sulphur was first manufactured in 1861. The first bar of tin, fashioned in the United States from native ore, came from a California mine; but, as an industry, tin mining has thus far proved unprofitable. Mineral soap, for which no better name has yet been adopted, was known to exist as early as 1849, and mineral paint has become an article of commerce. Building stone is abundant, a marble quarry in Tuolumne county being worked in 1857, while, near Auburn, in Placer county, is granite of excellent quality. Of mineral springs there are fifty which serve as health resorts, with twice as many more unknown to fame. Among metals and minerals but little utilized may be mentioned saltpetre, asbestos, antimony, platinum, chromium, mica, bismuth, zinc, and iridium. Such are the principal resources of California as a mining region, here mentioned not with intent to give special prominence to that state, but because, as elsewhere on the

Pacific slope, these resources, apart from the precious metals, are as yet but little appreciated.

To the Pacific states a liberal space was allotted in the southeastern section of the hall of Mines and Mining, flanked on one side by exhibits of mining machinery, and separated by the central nave from those of foreign lands. In front of the group is the pavilion of the golden state, in which are displayed to excellent advantage her many varieties of building materials. The portal is constructed of various kinds of stone, in the form of a triple arch, thirty-six feet in length, with wings on either side, with base of dark granite and white marble columns from Colton and Inyo quarries. The caps of the columns are richly carved, supporting a handsome entablature, and behind them are pilasters of onyx, beautifully veined. The arches are of grey sandstone, the panels and pediments of variegated marble, and the wings of blue green-stone, nearly all the best of California's building stones, some of them highly polished, being represented in this pavilion.

The specimens gathered during a series of years by the state mining bureau forms the basis of the exhibit, and to these were added contributions from private collections, forming together a valuable assortment of economic minerals, some of them almost a novelty to the scientific world. In double rows of show-cases are choice samples of gold and silver ores, containing some \$20,000 worth of metal, and representing all the more prominent mines. Here also is the metal itself in various forms; but the centre of interest in the California section was the hypothetical nugget which Marshall picked up in the Coloma mill-race on a January morning in 1848, the finding of which revolutionized the commercial conditions of the world. This, however, was a treasure supposedly of too great value to be trusted by its owner, even under the care of the Exposition authorities, and was removed not long after the opening of the Fair.

Upon the walls and around them are souvenirs and memorials of pioneer days, including a portrait



SILVER AND LEAD FROM UTAH

of Marshall, photographs of hydraulic mining and mining processes and districts, among them Sutter's mill and mine, with the primitive rocker and pan, the mining methods of those days being a cross between Mexican tradition and Yankee ingenuity. In models is illustrated the science of mine timbering, especially as applied on the Comstock lode, in Nevada, in what is known as the crib system of timbering, invented by a German miner and scientist, Philip Deidesheimer by name. When a depth of some 200 feet was reached in the Ophir mine, the ore body was found to be 45 feet in width, thus rendering almost useless the post and cap system before in use, for such would not uphold the roof of the chamber. Then it was that this man came to the rescue, framing timbers in square sets or cribs from four to six in size, piled one upon another, and filled with waste rock, thus sustaining lateral as well as downward pressure. The plan was widely adopted; and but for this or some similar appliance, the deeper workings of the Comstock, which have added nearly \$300,000,000 to the stock of precious metals, would never have reached, as later they did, a depth of more than 3,000 feet. In statistical and other forms much valuable information is conveyed, and here not a few among the pilgrims of



the Fair will learn for the first time that of the total yield of gold, amounting since 1848 to \$1,900,000,000 for all the United States, California has contributed \$1,310,000,000.

Oregon's display, though unpretentious, was somewhat of a surprise to the majority of exposition sight-seers. Coal, iron, and copper were known to exist in abundance; but few were prepared to see in this collection such specimens of gold and silver ores as are here exhibited. Among them are samples of gold quartz assaying several hundred dollars to the ton, one of them from the surface croppings of a recently discovered mine. Nearly all the mineral products of the state are represented, and in a model is shown the process of hydraulic mining. In 1891 Oregon produced more than \$1,600,000 worth of gold, and some \$300,000 in silver, the former the largest yield recorded up to that date, the principal mines being in the southwestern districts where the veins are small but rich. Since, in 1855, the first cargo of coal was shipped to San Francisco from the Coos bay mines, these beds have been worked without intermission, the maximum yield of 82,000 tons being reached in 1887, while the gradual decrease to 35,000 tons in 1892 was due only to low prices and labor troubles; for the deposits are practically inexhaustible. In few sections of the United States are iron ores more widely distributed or more advantageously located, the Oswego works furnishing this metal to Oregon and California foundries for more than a score of years. Copper ores are plentiful and rich, though as yet but little utilized.

Of nickel there is in Douglas county one of the largest mines in the world, rivalling the famous deposit in the Sudbury district, in the Canadian province of Ontario. Platinum and iridium are found in connection with placer gold; cinnabar exists in several districts, and with marble, granite, and other building stones, few of the Pacific states are better supplied.

In Washington's tasteful pavilion of terra cotta are 150 tons of mineral samples, gathered from every mine at which samples could be obtained. Among them are gold, silver, iron, lead, and copper ores; with coal, granite, marble, and onyx; sands and clays; bricks,

tiles, and terra cotta; thus representing the principal mining resources and industries of this young and ambitious commonwealth. Here also, or in the state pavilion, are reproduced in models or in graphic art several of the more prominent mines, with the mountains and ravines in which they were discovered, with assays, statistics, and other information conveyed in attractive form. In the centre is a monument composed of gold, silver, lead, and copper ores, the shaft entirely of silver specimens, and around it groups of minerals in various designs. Near by is an ornate structure of similar materials, with a large mass of magnetic ore. The entire display is a credit to the evergreen state, which, to add to its attractions, purchased a number of gold nuggets, and even constructed roads to remote districts where contributions had been promised.

In comparison with other metals and minerals, Washington's yield of gold and silver is inconsiderable, the latter amounting for 1891 to less than \$600,000. During the régime of the Hudson's Bay company coal was discovered in the Cowlitz valley. In 1852 deposits were found on Bellingham bay, and between 1860 and 1879 produced at the rate of 13,000 tons a year. Meanwhile more valuable beds had been disclosed, and the total output gradually increased to its maximum of 1,264,000 tons in 1890, the yield for 1892 being estimated

at 900,000 tons. The entire area of coal lands has been stated at 180,000 acres, most of it within 40 miles of tide water, a single company owning claims on the Squak river two miles in length, with veins occurring at intervals from five to twelve feet in thickness, and said to contain 10,000,000 tons of merchantable coal. Bog-iron ore is abundant, and in Iron mountain, near the Snoqualmie pass, are veins of magnetite from 50 to 150 feet in thickness. On Kettle river are copper ores assaying from 50 to 75 per cent, all these and other resources as yet almost untouched.

Turning to the adjacent state of Idaho, we find that her yield of the precious

metals was estimated for 1892 at 90,000 ounces of gold and 3,250,000 of silver, the latter the smallest output in several years, due to extreme depression in prices, and to labor troubles in Cœur d'Alène, the principal argentiferous district. From the low-grade galena ores of this district, occurring in veins of considerable width, and with no indications of failure as depth is attained, were extracted in 1891 nearly 2,000,000 ounces of silver, and



COLORADO EXHIBIT



COLORADO'S PAVILION



NEW MEXICAN MODELS

copper ores of the Bear lake district assay as high as 75 per cent. of sulphur, much of it containing 70 to 80 per cent of mineral, and at the Oneida salt works a marketable quality of salt is produced by simply boiling the water of springs in galvanized iron vessels. In northern Idaho there are mica, marble, granite, and sandstone, and almost throughout the entire country metals and minerals of economic value are widely distributed.

First among the hundreds of exhibits contained in Idaho's classic pavilion, colored in white and gold, may be mentioned that of the state, including, among others, samples of gold, silver, and

copper ores, cinnabar, building stones, and clays, quartz crystals, sapphires, amethysts, and ruby sands. From nearly all the more prominent mines contributions were secured, each county being thoroughly canvassed, and with the result that nearly 2,000 samples were forwarded to Jackson park in several car-loads. Not a few of these are contained in the 2,500 cabinet specimens, selected by an expert, who also states the name of the mine and its owner, the

assay value of the ores, the depth at which they were obtained, and other information of interest to mining men.

Gold and silver are freely displayed in the Idaho section; the former in the shape of nuggets from private cabinets, some of them found in the placers worked in pioneer days. Of wire silver there are beautiful specimens, delicate threads of pure silver, resembling filigree work, clinging tenaciously to bunches of galena ore. Among the exhibits are two rectangular blocks of what appears to be lead bullion, but is in fact galena ore, containing 75 per cent of lead, 15 of sulphur, and 130 ounces of silver to the ton. Of palladium ore there are samples from the Esmeralda mine in Lemhi county, where it is found in bunches yielding two or three ounces to the ton, in combination with free milling gold. This rare and valuable metal possesses the hardness of the finest steel, and is used, among other purposes, for astronomical, surveying, and electrical instruments, the main

66,000,000 pounds of lead, Idaho ranking next to Colorado in production of the latter. Says one who has made a careful study of her mines: "Cœur d' Alène is most favorably situated for producing lead, the silver being almost a by-product. The ore is cheaply worked, and numerous streams afford ample water power. These mines can be operated at a profit with the price of white metal so low that others are compelled to shut down."

Apart from the precious metals, Idaho has an abundance of coal, iron, copper, sulphur, and salt. From the Narragansett mine in Owyhee county iron ores have been taken so rich in metal as to be cast into dies for stamp-mills, and elsewhere are veins which yield from 50 to 60 per cent, while the



MONTANA'S SILVER STATUE OF JUSTICE



MANUFACTURES AND GOVERNMENT BUILDINGS FROM THE LAGOON

supply coming from South American countries.

Of pure aluminium there are samples extracted from the clay banks of Kootenai county, said to contain more than forty per cent of the metal. Among valuable stones are the onyx and opal, the latter found in a recently discovered mine on the banks of Snake river, and taken from matrices several inches in width. From Lewiston comes a specimen of rock almost unknown to scientists, of variegated tints somewhat resembling jasper, and one that will cut glass more readily than a diamond. Iron and copper ores are in liberal supply, and a large case is filled with samples of lead and copper concentrates; of granite, marble, and alabaster there are several exhibitors, and of asbestos



MONUMENT OF GERMANIA IN PORTLAND CEMENT, MANSKE EXHIBIT

there is a sample from Owyhee county, where a deposit was found in the autumn of 1892. Finally there is a large collection of mineral waters, in which, as in other resources, Idaho is especially rich, awaiting only the means of transportation for their fuller development.

Except for Alaska, whose yield of gold already exceeds \$2,000,000 a year, and with one of the largest gold quartz mines in the United States—the Treadwell lode on Douglas island—with immense deposits of low grade but dividend paying ore, Nevada is the only section of the Pacific slope that is not represented among the main exhibits of the Mining department. And yet, not many years ago, Nevada was the largest silver producing region in the world, the bullion product of the Comstock mines alone amounting to \$350,000,000, and for the single year of 1876, when the maximum was reached, to more than \$70,000,000.

Utah has some 300 exhibits of gold, silver, silver-lead, copper, zinc, iron, and other ores, with building stones, coal, antimony, quick-silver, sulphur, salt, asbestos, and other metals and minerals, all neatly arranged and fairly representing the abundant mineral resources of the territory. In iron Utah is especially rich, with surface deposits in Iron county alone estimated at 50,000,000 tons, one of them a solid mass of magnetic ore, 1,000 feet long and half that width, from which analyses show from 60 to 65 per cent of metal.

Of the 163,000 tons of copper obtained from domestic ores in 1892, more than one-half came from Montana, whose yield for that year was 82,150 tons, against 53,700 tons for Michigan mines. Of this enormous output, the largest thus far on record for a single state,

50,000 tons came from the Anaconda company's works, whose property includes, besides the mine of that name, the St Lawrence and the so-called Chambers Syndicate mines. Of the precious metals Montana is also one of the largest producers, her yield of silver exceeded only by that of Colorado. Of gold, silver, lead, and copper her total output for the decade ending with 1890 was estimated at \$250,000,000, of which more than two-thirds consisted of gold and silver. In that year was claimed for this state the largest gold mine, the largest silver mine, and the largest copper mine in the country, and in the following year the volume and value of mining products were the largest yet recorded.

Of the several hundreds of exhibits displayed in the Montana section, more than sixty consist of copper and silver-copper ores, both metal and mineral being displayed in every phase of production from sulphides



MEXICAN ONYX

and matte to sheet, tube, wire, and other manufactured forms. Of silver, gold, and silver-lead ores thousands of specimens are exhibited by more than 400 contributors. There is also the largest collection of nuggets contained in the Mining hall, one of them weighing nearly 48 ounces, and with 96 per cent of pure gold. Near it is a display of gold crystals, sapphires, and garnets from El Dorado bar on the Missouri, and within a few miles of Helena, and in another case are trays of gold-dust from the placers, each one holding about \$1,800 worth of metal. Of coal there are many samples, and the building and other stones and minerals of economic value include granite, marble, porphyry, limestone, clays, gypsum, sulphur, graphite, and asbestos.



FOREGROUND OF THE STUMM EXHIBIT

which stands a case of specimens from the Elkhorn district, is the statue of Justice, fashioned of native silver, and with orthodox scales and sword. In this statue, placed under a canopy of maroon velvet, in the centre of the pavilion, and guarded by two bronze lions, was used nearly a ton of sterling silver, the figure resting on a silver globe, beneath which is an eagle with outstretched wings. The lower portion of the pedestal is of ebony, and upon this is a plinth of pure gold, more than two feet square, and representing, as is said, a value of \$250,000. The model selected for this, the largest silver statue in the world, was the actress Ada Rehan, whose stately and opulent form is cast in heroic mold. Behind the statue is a structure fashioned of copper bars; on the walls the more prominent mining centres are reproduced in photographs, and at the back a painting, named *A Good Strike*, represents the scene which its title indicates.

Colorado is well represented, as befits a state which in 1892 produced \$5,500,000 in gold and more than \$30,000,000 in silver, taking the lead of all other sections in her output of the precious metals. Of coal the production increased from 4,500 tons in 1870 to 3,800,000 tons in 1892; of iron the yield for the latter year was 32,000 tons; of lead, 61,000, and of copper 3,600 tons. Add to this her wealth of building and other valuable stones, her carnelian, chalcedony, onyx, jasper, jet, and agate; her petroleum deposits, almost rivalling those of Pennsylvania, and already producing at the rate of several millions of gallons a year, and it will be seen that Colorado is not wanting in mineral resources.

The section allotted the centennial state, adjacent to the southern portal of the building, is faced along the aisles with marble, and on either side of the main entrance are polished granite pillars with capitals of red sandstone. Within is a circle of columns fashioned of various building stones, and a pillar of granite surmounted by a globe, and a massive coal trophy, eight feet square at the base and twenty-four in height, dominate the entire display. Two sides of the structure are lined with cases filled with specimens of ore, and masses of gold and silver bearing quartz are grouped along the aisles, while in the centre, wire, nugget, placer, and other forms of gold from the Breckenridge district are freely displayed, together with gold and silver roses from a Denver exhibitor.

Among the many thousands of cabinet specimens contained in this collection, including those in the gallery, a large proportion was furnished by the state school of mines at Golden, and from the Colorado scientific society are samples of eruptive rocks and meteorite, forming together a most valuable and comprehensive assortment. From the more valuable mines there are also contributions, and from business, manufacturing, and other firms and companies are exhibits of coal, coke, iron, marble, building stone, slate, clay, asphaltum, petroleum, mineral waters, and other products, together with smelting and refining processes. Above the cabinets are photographs of the principal mining regions, and of buildings fashioned of Colorado stone, while in map form are depicted the geological and topographical features of the state.

The state has a large and valuable collection, among which are silver, silver-lead and iron ores, and surface copper; marble and other building stones; yellow and red ochre, manganese, malachite, chrysolite, tourmaline, dendrites, stalactites, rhyolite, rose and agatized quartz, garnets, jasper, and chalcedony. In a tin brick weighing some thirteen pounds, made by the students of the college of Montana, is represented the yield of that metal for 1892. Another curiosity is an old wooden cam which did service in 1864 at a four-stamp mill on Grasshopper creek, in the Bannack district, where two years before were discovered its placers and quartz ledges.

But the centre of attraction in Montana's beautiful pavilion, at the entrance of



GERMAN WIRE CABLE

From Aspen come samples of silver ore that average from 70 to as much as 20,000 ounces to the ton, the latter rather an exhibit of metal than of metal bearing rock. From Leadville are also some high grade specimens from the Chrysolite mine, especially of bromo-chlorides; Forest city sends carbonates that assay 2,500 ounces, and the Lion mine carbonate ores almost as valuable. Of auriferous ores there is also a large collection, including ore from the Elkton mine containing more than \$7,000 to the ton in free gold; from the Blue Bird mine telluride which yields up to \$1,200 a ton, and others whose average varies from \$7 or \$8 to \$1,100. Of turquoise there are beautiful specimens from the Blue Gem mine at Villa Grove, and in a word nearly all the minerals of economic value contained in the centennial state are here on exposition.

Arizona's exhibits, adjoining the Colorado section, are displayed to excellent advantage on a raised platform, in the centre of which is a monument of copper ore, in rich colors of blue and green, one of the



specimens of which it is composed weighing nearly 7,000 pounds, and the smallest exceeding 800 pounds. Around it are cases of cuprite, azurite, malachite, and other minerals of brilliant hue, some of the samples from the Holbrook mine, where is a cave of stalactite, being covered with incrustations of silver. In blocks of ore assaying from 30 to 70 per cent are represented all the more prominent copper mines of Arizona, whose total yield for 1892 was estimated at 19,000 tons. The metal itself is shown in the form of bricks, bars, sheets, rolls, plates, wires, and all other forms in which it is manufactured, and from one of the exhibiting companies are models of its mines and apparatus.

Of gold and silver ores and ores of silver and lead there are nearly 100 exhibitors, one piece of gold ore assaying a dollar to the pound; and from Cochise county, which furnishes the bulk of the collection, are a few gold nuggets, and a sample of onyx nearly eight feet long by two in width; while Mohave county, which is also well represented, presents specimens of agate and silver glance or sulphurets. Sandstone of finest grain is shown in the form of slabs and pillars, and there are portions of petrified trees, some of them beautifully polished.

Almost in the centre of New Mexico's section is a structure composed entirely of native ores in the form of a miner's cabin, and near it are relief models of several prominent mines. Beyond are pictures of the typical miner in orthodox costume, and with his patient and long-suffering burro. Here and in the western galleries is a large collection of minerals, including all the varieties discovered since, in 1832, were extracted from the so-called old placers a few thousand dollars worth of gold. Nearly all the metals common to the Pacific slope are contained in these sections, the greater number of the exhibits consisting of gold, silver, silver-lead, and copper ores; while coal is represented in the form of a pyramid, its materials furnished by the Madrid mines, the property of a railway company.

Coal is the feature in Wyoming's exhibit, representing an industry whose output for 1892 was 94,000 tons. Iron and copper are widely distributed; but neither have been as yet extensively worked, though in Albany county is a mountain of ferruginous rock assaying as high as 80 per cent of metal. Petroleum is found near the surface in many localities; near Laramie is a large deposit of mica; building stone is abundant; agates, amethysts, and other valuable stones have been found in the valley of the Sweetwater river; plumbago and graphite, soda, sulphur, asphaltum, and asbestos are among Wyoming's minerals, and the precious metals are found in many portions of the state. All these are represented in her pavilion, in which the central point of interest is a shaft of coal from the Black hills mines, most of the material furnished by the Union Pacific Coal company's works at Rock springs. The Wyoming Railway and Iron company has a large collection of ores; asphaltum is freely displayed, and in glass tubes are the various grades of petroleum manufactured by the Black Hills Oil company.

In addition to those already mentioned, California, New Mexico, Nevada, and Colorado have exhibits in the northwestern galleries, consisting principally of cabinet specimens, covering the entire field of their



ENTRANCE TO ONTARIO EXHIBIT

mineral wealth. Nevada, to which no space was allotted on the ground floor, occupies the largest area, the White Pine district making an elaborate display. In quartz crystals and ornamental stones the collection is especially rich. The Gunnison region of Colorado sends many specimens; but the feature in this section is the heroic figure of the Silver Queen of the World, seated in a triumphal car of silver, the canopy overhead and the foundation upon which it rests being richly encrusted with powdered crystals. This foundation serves as the entablature of several marble pillars, those at the main entrance being arranged in pairs. Cupids precede the chariot, scattering as they run disks of gold and silver, each piece as it falls from their cornucopias displaying the watchword, Free Coinage. Beneath their feet and upon the front of the structure are skilfully fashioned in mineral substances the words, Aspen, Colorado; and specimens of ores and gems are tastefully displayed.

First among the exhibits of foreign participants may be mentioned Germany's elaborate display, one in which are fully illustrated the mining and metallurgical industries of an empire which ranks first among the continental nations of Europe, her volume and value of production exceeded only by that of England and the United States. Of gold and silver extracted from native ores the yield is inconsiderable; but from imported ores there were produced in 1890 several thousand pounds' weight of gold, and of silver, in connection with the smelting of lead and copper, more than 400 tons. Of coal the German output for 1892 was 71,000,000



CANADIAN NICKEL ORE

with fire-breathing dragons at his feet. Within is a large metal basin, on which are the brawny figures of workers in iron, assisted by sturdy lads, one of whom is helping to grasp with his tongs a bar just issuing from the roller, while the other is pushing a cart filled with molten ore. Above this group is a bust of Baron Stumm, the founder of the works from which it came, the Vereinigte Eisenwerke of Neunkirchen, one of the largest of Prussian foundries, employing several thousand hands, and producing an enormous quantity of manu-

factured iron. Among its exhibits, which form one of the most imposing collections in the hall of Mining, is a portico of cast iron pipes, flanked by obelisks of rolled and forged iron, the metal being displayed in many structural forms, including coils of wire towering like some huge tropical plant, almost to the roof of the building. In the background is a terrace of rails, and above it a cold-bent specimen, stretching in serpentine form along the rear walls. Here also is reproduced the iron superstructure of the Gott-hard railway station, and near by are models of the mills and the dwellings occupied by mechanics.

Near the southern portal of the hall, not far from the Colorado section, is an imposing structure composed of seamless steel tubes, erected by the Mannesmann works of Berlin. The exhibit consists of tubing for boilers and pipe lines, whether for oil, gas, water or steam, and hollow tapered poles for telephone, telegraph, electric light, and electric railway purposes. The special feature in these articles is that all are rolled from solid blocks by a patented spiral process, which causes the fibres to twist

into a rope-like and extremely tough material.

Elsewhere in Germany's section are specimens from her quarries and coal mines, with coal tar, oils, and paraffine, graphite and its products, and ornamental specimens of zinc. A Heidelberg firm has erected an elaborate structure composed of cement and gravel, though seemingly fashioned of limestone of a bluish tint. At the entrance is an archway with female figures in classic pose. Of cements there are several exhibits, and in the display of a Berlin laboratory are machines and apparatus for comparative tests of this compound, especially of the Portland variety, the experiments conducted in accordance with regulations framed by the government. By the Lehrte and Misburg firm of Manske and company was erected, near the live-stock pavilion, a portal of artificial sandstone, on which is a heroic statue of Germania, its flooring and stairway made of slabs of cement, and with piles of casks containing the manufactured article.

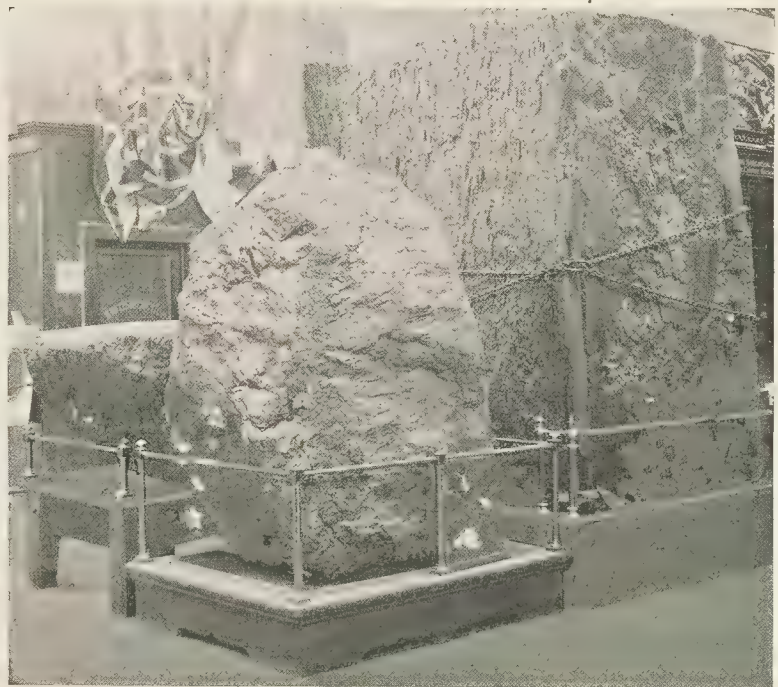
In the gallery the German division is in compartments, in one of which is a tall gilded shaft, its face

tons; of pig iron, 4,900,000 tons; of sulphur and sulphuric acid, 437,000; of zinc, 140,000; of lead, 98,000, and of copper, 25,000 tons; these representing the principal economic minerals whose product was valued for that year at about \$225,000,000. Copper is largely imported, the only important deposit being a vein of cupriferous schist in the Mansfield mines, of inferior quality, but largely utilized through elaborate mining processes; for the Germans have no superiors as metallurgists, the inception of this science dating far back to the prehistoric era of the fatherland, and in the middle ages attaining a higher development than elsewhere in the world.

The German exhibits are divided between the ground and gallery floors, the latter containing chiefly such as pertain to metallurgy and mining processes and apparatus. A considerable portion of the ground floor space is occupied by the Stumm pavilion, at the entrance of which is a massive iron gateway, surmounted by the heroic figure of a blacksmith,



MICA AND LIME



BRITAIN'S TROPHY OF COAL

representing in sections the relative yield of mineral products. Amber is freely displayed, and in many of the specimens are imbedded various forms of insect life. Other attractions are a tower of iron ores, a model of the Royal Prussian salt-works, and a scientific collection of crystals, with models of crystalline forms, showing geometric figures in different minerals and their interior lines of contact. But the feature of the gallery groups is the models of mines, illustrative of processes and apparatus, and especially of coal mines, by which are produced so large a proportion of the mineral wealth of the empire. The last are contained in the general exhibit of Prussian mining, some of them showing the method of wetting the face of the works so as to prevent the spread of fire-damp. Here also is shown a coal dressing plant at the royal mines at Saarbrück, with a drift run in the König colliery to test the use of explosives in the presence of fire-damp.



UNITED STATES SECTION—MEXICAN AND GERMAN EXHIBITS TO THE LEFT

Coal and iron are the principal mining products of the British isles, the value of the former being more than six times that of the latter even in metallic form, while the annual yield of pig and bar iron represents nearly 90 per cent of the total value of all metals produced from native ores. In 1891 there were extracted 185,000,000 tons of coal, worth \$350,000,000, and giving employment directly to 650,000 miners and laborers; of iron ore nearly 13,000,000 tons were worked into \$58,000,000 worth of metal; of lead the output was 32,000 tons; of tin and zinc, each about 9,000, and of copper only 700 tons. The last of these metals is now almost entirely imported, its production steadily decreasing since 1855, in which year the production was 21,000 tons. Meanwhile the steadily increasing yield of the United States, Chile, Australia, and other countries had diminished the price by nearly 60 per cent; this, with the gradual exhaustion of the larger deposits, causing a virtual cessation of copper mining in Great Britain. Of iron the production also shows a decrease of about 20 per cent within the last fifteen years, and with a more serious decline in value. Of non-metallic minerals apart from coal, and consisting mainly of building and other stones, clays, gypsum, salt, and oil shale, the yield may be estimated at \$70,000,000, and the entire mineral yield of Great Britain is not far short of \$450,000,000. Silver, found in combination with lead ores, is produced at the rate of 200,000 or 300,000 ounces a year, and of gold a few hundred ounces have been taken from low grade deposits in Wales, while from a mine in Wicklow county, Ireland, have come a few ounces, costing perhaps fifty times their value to extract.



PRINCIPAL ENTRANCE TO SECTION OF NEW SOUTH WALES

First among the British exhibits may be mentioned the large collections of minerals, somewhat too widely scattered around the pavilion, but representing together all the minerals of economic value found in the United Kingdom. Among them are many specimens of interest to the scientist, as of the blue-ball clays used for a century or more in the manufacture of the finest descriptions of earthenware; flint and flint implements such as Britain has produced from time immemorial, jet from jet shale in Yorkshire beds, and auriferous quartz with its encasing rock from North Wales. The processes of smelting lead and copper ores are shown in samples from metallurgical works, the former both by reverberatory and blast furnace methods, and the metallurgy of nickel is displayed in samples from a Birmingham establishment, while Sheffield and Bradford firms show how steel and iron are wrought into various forms.

Among the blocks of coal is one second only to the Washington specimen, contained in her state pavilion and presently to be described, the former weighing more than 28,000 pounds and containing 350 cubic feet. Of building and ornamental stones there are slate and granite, the latter in many shapes, as polished columns, monuments, crosses, and concrete paving blocks, with porphyry from ancient Egyptian quarries worked by a London firm as concessionaires. Another group consists of Portland and other cements, limestone, and artificial stones. Fire clays and fire bricks are freely exhibited, as also are kaolin and fuller's earth in its crude and manufactured state. Iron, copper, lead, cobalt, antimony, manganese are among the samples in the collections above referred to, and elsewhere are salt in display and decorative forms, and an assortment of grinding, abrading, and polishing substances and apparatus. While in some respects a creditable exhibit, the British section does not worthily represent the great variety and volume of the mineral products of that country.

To much better advantage appears the dominion of Canada, in her ample space to the north of the British division, and extending thence beneath the gallery floor. First among the exhibits may be mentioned the collections of the Geological and Natural History survey at Ottawa, and of the several provincial governments, including British Columbia and the Northwest territories. In these are included all the economic minerals contained in the dominion, some of them here for the first time placed on exposition. From the Sudbury district in Ontario comes an ingot of pure nickel weighing 4,500 pounds, with ores and mattes sufficient to give color to the superintendent's opinion that nickel will take the place of tin in the manufacture of household utensils. The ores are mainly of the pyrrhotite description, and of these there are samples from other Ontario mines. Of gold and gold bearing rock the



MINERAL MONUMENTS OF AUSTRALIA

province sends many specimens, most of them from her government collection, and of native silver, silver ores, and argentiferous galenas the exhibits are almost as numerous. Of platinum there is a small display, and of antimony a single specimen from a vein where it is found in combination with silver, lead, and sulphur. There is zinc blende from the Thunder Bay district on the northern shore of Lake Superior. Iron in the form of magnetites, hematites, bog-iron, and magnetic iron sand comes from several score of deposits.



IN THE FRENCH SECTION

Copper and copper ores and pyrites are in plentiful supply, the largest mass being of copper-nickel ore, weighing 12,000 pounds, and forming, with other blocks of copper and nickel bearing rock, a trophy display from the Canadian Copper company. There is a profusion of building and ornamental stones, of clays, marls, and kaolin; of graphite, steatite, actinolite, and molybdenite; with salt, gypsum, quicklime, and hydraulic cement. Apatite, or phosphate of lime, is prominent among the group of fertilizing substances. The Imperial Oil company has a large assortment of petroleum and its products. Asbestos is a feature in the Ontario section, as also are the sheets of mica and the delicately tinted variety known as amber mica, of which there is a crystal weighing 400 pounds from the Godfrey mine in Frontenac county, where in the Sydenham district similar crystals have been found six feet in diameter and with a weight of several tons.

In the exhibits of other provinces those of Ontario are in a measure duplicated. Quebec's collection rivals that of the sister province, especially in the display of asbestos, mica, plumbago, phosphates, building stones, and iron ores, the last from the Canada Iron Furnace company of Montreal. Among New Brunswick specimens are red granite, freestone, and other building stones, with gypsum and plaster. In the Nova Scotia department are many samples of gold and gold-bearing ores, some of the latter assaying many thousand dollars to the

ton. In the central court of the Canadian section is displayed in pyramids of gilded blocks the yield of gold in the several provinces since first it was discovered in British Columbia. Here is represented the output of that province, amounting since 1858 to more than \$53,000,000, with a production since 1862 of about \$9,000,000 from the Cambrian rock formations on the eastern coast of Nova Scotia, and smaller amounts from Quebec, Ontario, and the Northwest territories, the last producing only since 1889. In numerous samples Nova Scotia shows her wealth in coal, for here are some of the largest carboniferous deposits in the world, one of the mines running far under the bed of the Atlantic, and with seams of extraordinary richness. British Columbia and the Northwest have also many specimens of bituminous and anthracite coal, and from the latter are samples of coal tar, petroleum, clay, and building stone. Finally there are shown in topographical and geological charts, in sectional maps, in photographs and drawings, the locations of mineral regions, together with the more prominent mines, their workings and processes.

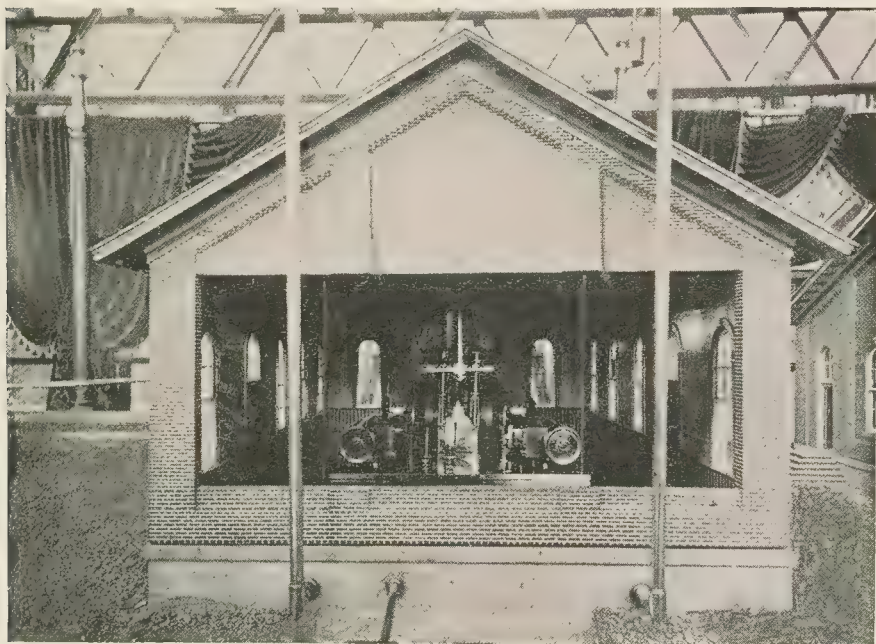
With all her wealth of resources, it is somewhat remarkable that Canada imports more largely than she produces of minerals and their manufactures. First on the list of her products is coal, of which 3,400,000 tons were extracted in 1891, and next in the order named, in relative value, are copper, gold, petroleum, asbestos, iron, and silver. For that year her mining output was estimated at \$20,400,000, against \$25,000,000 of imports, the latter mainly in the form of manufactured iron and steel, which alone amounted to \$14,000,000. Ontario is especially rich in minerals; and here have been recently discovered immense deposits of nickel, especially in the Sudbury district, whence, though the ores are of low grade, yielding on an average less than three per cent, \$2,700,000 worth of that metal were exported in 1891. Of iron, chiefly in the form of magnetites and hematites, and in quality equal to the best of Sweden, there are large and valuable strata. Coal is widely distributed throughout the dominion, the area of coal-bearing lands in the Northwest territories alone being estimated at 65,000 square miles.

From the far north let us turn to the great southern continent, where beneath the



METALS AND METAL WORK

Southern Cross is a land abounding in mineral resources. As in other departments of the Fair, New South Wales is the only Australian colony represented in the mining division, but in this section is fully illustrated the mineral wealth of a country which has thus far produced a larger amount of gold than all the United States. Since, in 1851, a luckless prospector, observing that the California placers were found amid geological formations closely resembling those which he had seen in Australia, and taking ship for that country straightway discovered gold, the southern continent has added more than \$1,600,000,000 to the world's stock of the precious metals. Victoria is the largest producer, her total yield up to the close of 1892 being estimated at



COAL AND COKE

\$1,300,000,000, and of the remainder nearly \$200,000,000 is accredited to New South Wales, whose output gradually diminished from \$56,000,000 for the decade ending with 1860, to less than half that amount for the ten years ending with 1890. The discovery of large silver deposits in the latter colony is of comparatively recent date, and yet from a single district were extracted in 1892 nearly \$12,000,000 of that metal, with more than 40,000 tons of lead.

By visitors of all nationalities it is conceded that the exhibits of New South Wales form one of the most interesting and comprehensive collections in the hall of Mining, far surpassing those of Great Britain and other countries whose appropriations were of much larger amount. In several thousand packages were forwarded hundreds of tons of specimens, consisting largely of gold in every conceivable form, but including also many samples of silver

and silver ores, of coal, iron, copper, lead, antimony, bismuth, and cobalt, with building, ornamental and precious stones, mineral paints, petroleum, cement and lime, and diamond-bearing earth.

At the entrance of the pavilion, fronting on the central nave and north of the Canadian section, is a pillar of frosted silver from the Broken Hills Silver Mining company, whose veins bid fair to rival the far famed lodes of Potosí.¹ The shaft is festooned with garlands and surmounted by a figure of Atlas, supporting his customary burden, with masses of ore at its base, and on one side minor structures of copper, tin, antimony, and silver. From the government collection are silver ores and blocks, and in a nugget of virgin gold is represented \$6,000 worth of that metal, with gold quartz assaying 258 ounces to the ton. To the exhibit of private stones there are contributions from several private collections, and of special value is the display of opals.

In the background of this section are inscribed on a lofty wall statistics as to the mineral yield of New South Wales. Here the visitor may learn that this colony has produced gold to the value of \$187,000,000; silver and lead, \$54,000,000; coal, \$124,000,000; tin, \$46,000,000; copper, \$29,000,000; iron, \$1,800,000; and petroleum and other mineral oils, \$6,000,000. Add to these the value of other products of the mine, and we have a total yield of at least \$500,000,000, for a country whose population in 1892 did not exceed 1,200,000 souls.

Beneath these figures are pillars of various minerals, one of them in the form of a vertical section of kerosene shale. Coal is liberally represented in columns, blocks, and smaller specimens, and in diagram form are shown the thickness of seams and geologic formations of the more prominent districts. Elsewhere are tin, copper, antimony, bismuth, mercury, and iron ores, some of them arranged in structural forms, with ingots and bars of tin and copper, and specimens of the tin-bearing granites of New South Wales, which closely resemble the Cornish formations on the southwestern coast of England, whence tin was extracted long before Boadicea did battle with the Roman legions. Building stones are freely displayed, as also are clays and bricks, and in the form of an entrance way are specimen blocks of colonial marble.

Though as a mining country France does not compare with Great Britain or Germany, her production of metals and minerals is very considerable, the yield for 1892 being valued at more than \$90,000,000. Of coal the output for that year



SPECIMEN OF DOMESTIC ORE

¹Between May 1886 and May 1892 there were taken from the most productive of the Broken Hills mines 36,500,000 ounces of silver and 150,000 tons of lead, some of the ore assaying many thousands of dollars to the ton. Meanwhile more than \$1,300 a

share had been distributed as dividends and bonus on stock on which only \$45 a share was paid up, thus giving a net return of over 3,000 per cent on the invested capital, probably the largest recorded in the history of silver mining.



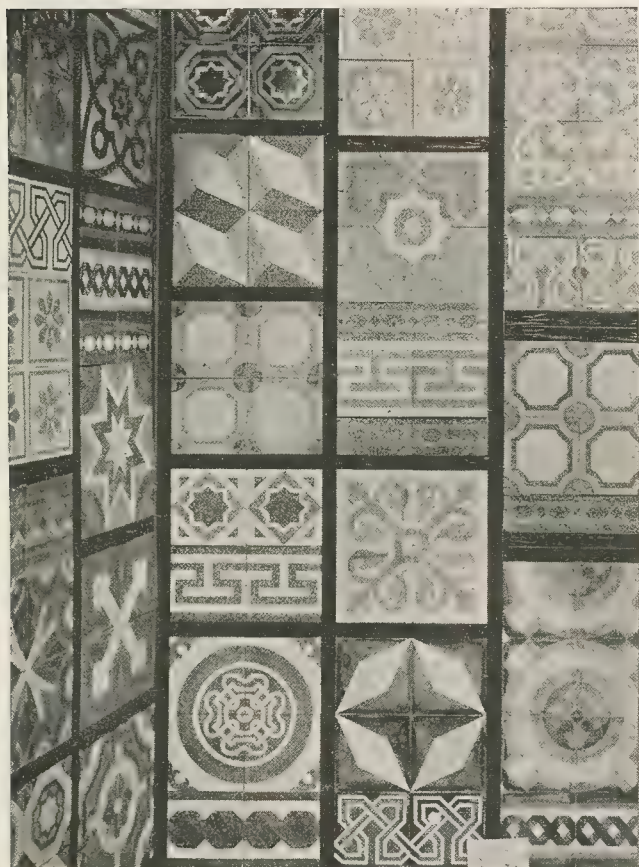
ALONG THE SOUTHERN SHORES OF THE WOODED ISLAND

was estimated at 26,000,000 tons, and yet with imports of 10,000,000 tons, thus making an average consumption of nearly a ton a year per capita of her population. Of pig iron the annual product is about 2,000,000, and among other metals the largest yield is of zinc, lead, and copper, with a few kilogrammes of gold and a large amount of silver from imported ores.

The French section is adjacent on the north to that of New South Wales; a feature of it is an exhibit from what is claimed to be the only mine in the world which produces pure carbonate of magnesia. Among the more artistic collections are bronzes, enameled tiles, and casts showing the quality of molding sands.

Cement is largely represented; a Bordeaux mine-owner has a display of manganese, and a few samples of slate, coal, and patent fuels almost complete the list of what France has to show in the Mining hall in the way of native products. In common with Great Britain and some other foreign participants, France is not worthily represented in this department of the Fair, a large portion of her space being covered by a rustic pavilion, with a group of aquatic plants in the centre, affording a place of rest for weary sight-seers. From the Laurium mines in Greece, controlled by Frenchmen, are massive specimens of silver, lead, and zinc, and from New Caledonia a collection of nickel ores, chrome, and cobalt.

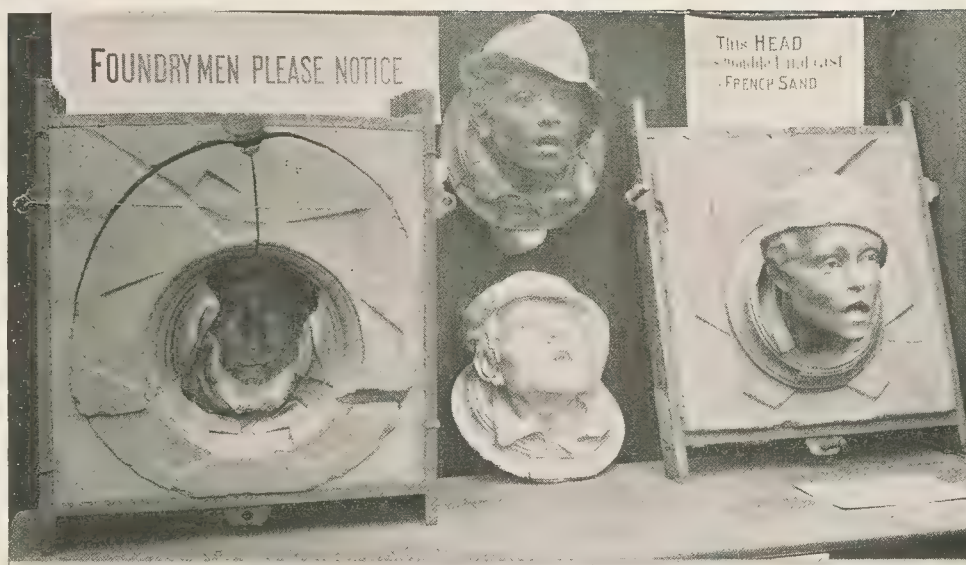
In the Austrian section, west of the French pavilion, are several exhibits worthy of note. The mineral waters of Carlsbad are contained in vessels fashioned in the shape of a pavilion, which presents in dioramic form this noted resort, with the lofty mountains that surround it. On the outer walls are depicted in detail the hotels, drinking booths, and architectural features of the place. But it is in iron and steel that Austria makes the best display, noticeable among her exhibits being a hexagonal structure of crucible steel, known as the Poldi variety. The posts, eighteen feet in height, were hammered from ingots, a centre-piece and several cases within representing various commercial forms of the metal, with sections fractured to show the uniformity of the material. Another exhibitor advertises his scythes by cutting sheets of the lightest tissue paper with their keen edges, and on the wall of the aisle is a sheet of iron 160 feet long, a yard in width, and one-twelfth of an inch in thickness, said to be one of the largest plates ever rolled. This, as well as the Poldi



DESIGNS UPON ITALIAN TILES

steel, comes from Bohemia, whose metal-workers are almost as famous as those who produce the beautiful glass-ware displayed in the hall of Manufactures.

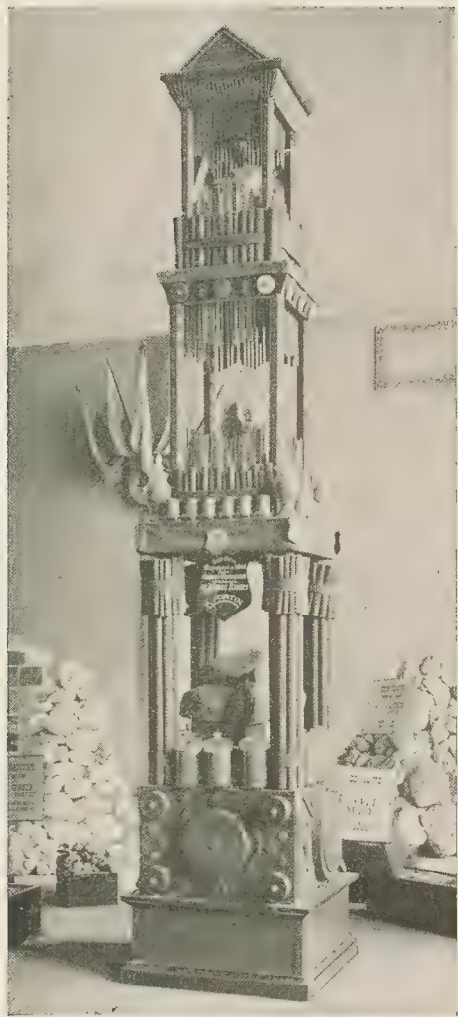
A feature in the Italian section adjacent to the Canadian groups is a translucent mound of alabaster, composed of blocks as taken from the quarries, side by side with which are beautiful statuettes and other sculptured forms. An admirable piece of work in their vicinity is the leaning tower of Pisa, cut from a block of alabaster extracted near that city. There are also many specimens of the famous marbles of Italy, including a large octagonal font, which for more than three centuries stood in the convent of Gesù e. Maria at Rome. This is made of the Claudian variety, one largely used by the Roman Catholic church, as in the cross on the "holy gate" of St Peters, and the consecrated stones of the altar. Sulphur from the Vesuvius and other districts is displayed in blocks and powders, with asphaltum, bitumen, and petroleum, also



MOULDINGS IN SAND. FRANCE



TILES FROM FRANCE



GRECIAN EMERY PAVILION

ture. The iron works of the Ural and other noted districts have also contributed of their ores and first forms of manufacture, and a fine display is made of swords and cutlery, many of the articles with handles of skilful design and workmanship. Maps indicate the most promising and productive districts for gold, coal, petroleum, salt, iron, copper, and other minerals. There are also photographs of the more valuable mines of coal and rock salt, and near one of the entrances are massive specimens of the latter, in contrast with which blocks of black marble display their shining surfaces.



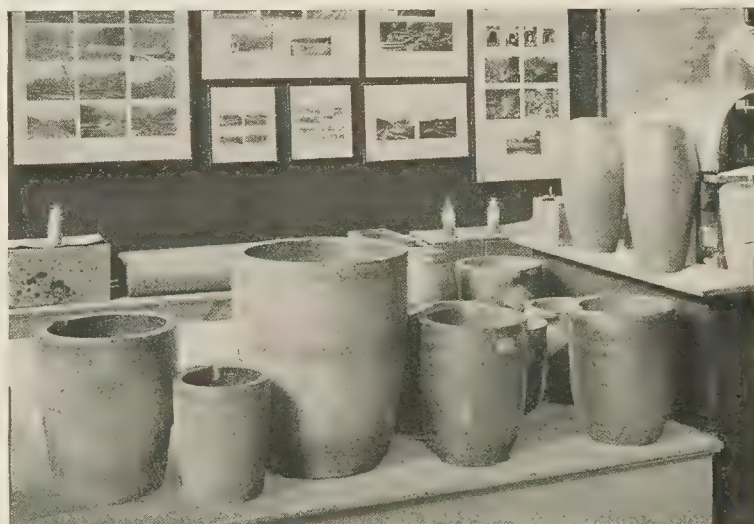
JAPANESE MARBLE

and maps showing the location of coal-fields and collieries, as well as the geological distribution of soils, while specimens of the soils themselves may also be examined, the entire exhibit being mainly organized by the mining and geological bureaus.

from volcanic regions, and tiles of cement richly colored and ornamented with geometric designs.

The Grecian section was originally allotted to the United States of Colombia, which accounts for its position among the Spanish and Latin-American exhibits. The display, although small, is suggestive, containing as it does contributions from the famous Laurium mines near Athens, whose treasures in the ancient days of her naval supremacy went far toward building her fleets and supporting her citizens in luxury. They are now controlled as I have said by a French company, which also exhibit brimstone and sulphur in ores and powders. Elsewhere are magnesite blocks, with emery and lead in crude and manufactured forms. Marbles from the classic isle of Scyros present a business-like aspect, as though advertising themselves, and an altar of Athenian marble is erected by the committee of Olympus, not in honor of the gods but of the Columbian Exposition.

In the western vestibule of the hall are three large gilded cubes, the inscriptions upon which inform us that since 1745, when Russian gold was first mined in commercial quantities, the empire has produced more than 1,800 tons of that metal, Siberia furnishing nearly three-fourths. South of this monument are shown in specimens and photographs the varied mineral resources of a domain which covers one-sixth of the entire land surface of the globe, one side being occupied with a row of cases in which are hundreds of bronze figures symbolic of civilization and barbarism. A shaggy-coated bear rears his unwieldy form beside the figure of a nobleman, and a gaunt wolf crouches near the feet of a richly attired lady. Horses, stags, and dogs, peasants and high officials, princes and Cossacks, with typical representatives of various classes are here reproduced in minia-

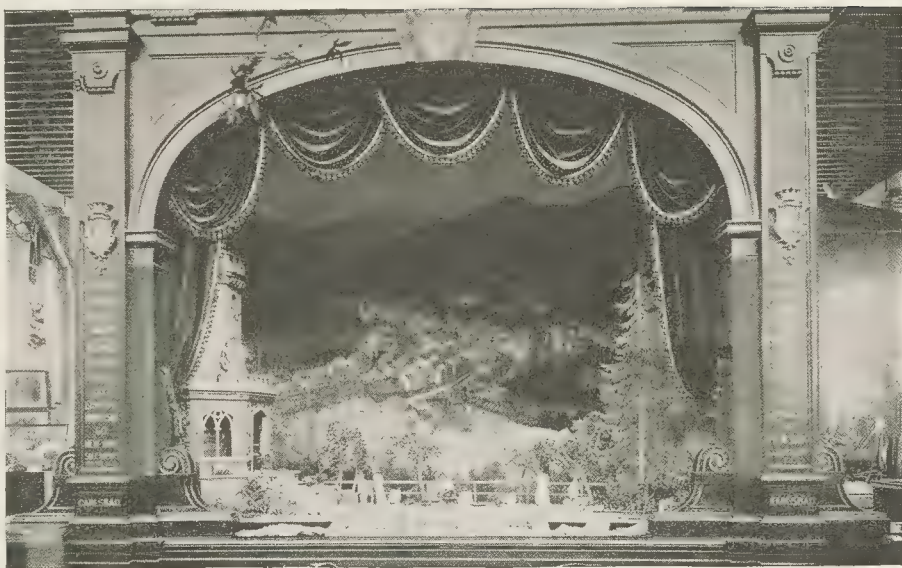


CRUCIBLES OF GRAPHITE

Adjacent to the Russian section on the north is the small space in which Japan reveals her mineral wealth, as yet but little developed. The entrance-ways are in rustic form, and within is a tastefully arranged, instructive, and unique exhibit. In the centre are ingeniously constructed models showing the cross sections of mines as worked in ancient and modern times. Front views are also given representing a dark cave which forms the inlet to the old mine, and an ornate pavilion through which one passes into the other. Japanese miners are shown in the narrowest of galleries, lying upon their backs or stomachs, working like slaves, and exposed to all the dangers of caves and explosions, while the tools and apparatus for extracting ore and pumping water are of the most primitive kind. As Japan has recently adopted modern machinery and methods of timbering, the interior view of the mine of to-day presents no remarkable features, the chief interest centring in the skilful workmanship of the model. Close at hand are specimens of coal and copper, silver and gold in the ore and leaf, antimony, commercial clays, variegated marble, graphite, sulphur, native and refined, and table salt in plain and ornamental forms, the first two articles representing an annual yield of about \$10,000,000. Among the minerals displayed in manufactured forms are crucibles made of graphite. There are also photographs of some of the most productive mines,

In the southwestern portion of the hall are the exhibits of Spain and Latin-American countries. The display made by the former consists of massive specimens of lead ore, with primary manufactures of lead, samples of copper, phosphates, salt, slate, marble, and many other minerals. There is also Cuban asphalt, which contains 70 per cent of bitumen, and is said to possess great commercial possibilities. Among the decorative features in the Spanish pavilion is a large array of mining tools, tastefully grouped at various points.

Elsewhere among these groups is sufficient evidence that the republican offspring of Spain are by no means lacking in enterprise. A pyramid in the centre of Brazil's pavilion represents the output in gold of the once famous Minas Geraes, which during the early part of the eighteenth century produced \$700,000,000 of that metal. Around its base are several varieties of marble and granite, while in trophy and other forms the coal mines of Rio Grande do Sul illustrate the mineral wealth of the country. Mica, quartz, and asbestos are shown in many beautiful forms, together with lead and copper ores, and the display of gems, though



AN AUSTRIAN PAVILION

brilliant, attracts less attention than a remarkable stone of elastic qualities, of which there are abundant deposits in the state of Minas Geraes.

The live-stock and agricultural interests of the Argentine Republic completely overshadow the mining industries, which thus far have not developed into commercial importance. In this department, however, the government bureau of mines and geology has tastefully decorated a large section in blue and white, installing therein specimens of marbles and other building stone, with clays and salts, iron and coal. The geological maps hung upon the walls indicate that the most promising mineral deposits are in the north-western portions of the country, near the headwaters of the Negro and Colorado rivers.

Ecuador and Bolivia have but a miniature display, the former presenting a few specimens of gold among a miscellaneous collection, while the ancient glories of Potosí are but feebly represented in the tiny pavilion of the latter, her mines, which in the sixteenth century produced as much as \$80,000,000 of silver



ALABASTER STATUARY

a year being almost abandoned. The largest mines are now at Huanchaca, and are mainly controlled by Chilean capitalists; but their wealth finds little expression in the hall of Mining. Other exhibits are masses of crude rubber, a portrait of the president, and a large table made by a resident of Cuzco, who informs us that he is no cabinet maker but sends his handiwork, composed of the choicest varieties of native woods, as a contribution to the Fair.

Nitrate of soda forms the text of Chile's exposition. It is displayed in various shapes, a large model of the famous works at Rosario de Huara showing one of the largest establishments for its manufacture in the world. Upon a shaft within this section are statistics as to the growth of this industry from 1830, when only 800 tons of nitrate were exported, until, in 1890, exports had increased to more than 1,000,000 tons. Not only is this a most important source of individual wealth, but the national treasury derives therefrom an annual income of \$20,000,000, or more than one-half of its revenue.

In Mexico nearly 4,000 mines are under regular exploitation, with others worked at intervals, and a vast number of abandoned claims, many of which if reopened would yield excellent returns. While as a rule



ALABASTER STATUARY



PORTION OF MEXICAN SECTION

processes are somewhat primitive, modern appliances have been largely introduced among the more productive mines, and especially in those which have passed under foreign ownership. One advantage is the cheapness of labor, wages varying, according to the nature of the task, from 50 cents to \$1.25 a day, the latter rate for the barrateros who extract the ore, sometimes receiving in addition a share of what they take out. Other fostering influences are the security for life and property established under the Diaz régime, and the building of railways, affording direct communication with the United States; for until recent years nearly all the heavier machinery was imported by way of Vera Cruz.

The history of mining in Mexico dates almost from the time of the Spanish conquest, and yet her deposits of the precious metals show no signs of exhaustion, the yield of those which have been abandoned being more than compensated by new discoveries. Between 1521 and 1891, a period of 370 years, the total production of silver has been estimated at \$3,570,000,000, and of gold \$277,000,000, while the present yield of both these metals may be stated at somewhat over \$40,000,000 a year. Of coal the annual output is worth about \$4,000,000; of copper, \$2,500,000; and for other minerals, metals, and metalloids, including iron, sulphur, salt, mercury, clay, and ornamental and precious stones, may be added a value of \$25,000,000, thus giving to her mining and mineral products a total valuation of more than \$70,000,000.



ROSE GARNETS

can be easily quarried, cut, and polished, and is not affected by the most violent changes of temperature. Technically it is described as a silicate of lime and alumina, and when worked into thin slabs and placed in a strong light, a beautiful color effect is produced, the garnets largely adding to its decorative qualities. Near

To Mexico was allotted a liberal space in the southwestern section of the hall, her display far surpassing those of Spain and other Spanish-American countries. Here, as in the Manufactures building, an attractive feature is the collection of ornamental stones, and especially of onyx, and a newly discovered variety to which has been given the name of rose garnet. The latter is one of the most remarkable of minerals, combining some of the best qualities of ornamental and building stones, and the only deposit thus far discovered is at Zalostoc Morelos, within 100 miles from Mexico, near a line of railway, and in sufficient quantity to permit systematic development. It is, moreover, a merchantable stone, one which, though harder than granite,



CAPE COLONY

an elevated platform, to which a stairway leads from the ground floor. First of all the sand is washed away from the pebbles in a large pan or pulsator, and that which remains is placed in a cylinder, with spiral motion and apertures of various sizes, through which the pebbles are dropped into the sieves beneath. These operations are conducted by stalwart Zulus, attired in full dress Exposition costume—a cap and a pair of short trousers; for other garments they cannot be induced to wear. One of the Zulus stands guard at the gate, armed with a war club with massive ivory head. He is a chieftain of his tribe, a man of gigantic stature, and one of the impi which defeated the British troops in the days of King Cetshwayo.

The pebbles are handed to the sorter, who spreads them upon a table and searches for the diamonds, several valuable stones being taken at times

the eastern entrance-way are pillars, slabs, and ornamental and geometric designs in rose garnet, while the rare beauty of its texture is further illustrated in a delicate plate of the mineral contained in an illuminating apparatus. Elsewhere the exhibits, selected with the utmost care through a commission appointed by the government, are for the most part arranged in cabinet form, many of them contained in handsome bronze show-cases. There is also a group of ore-washing apparatus, and viewed as a collective exposition of mining resources and industries, the entire display is one of which our sister republic has good reason to be proud.

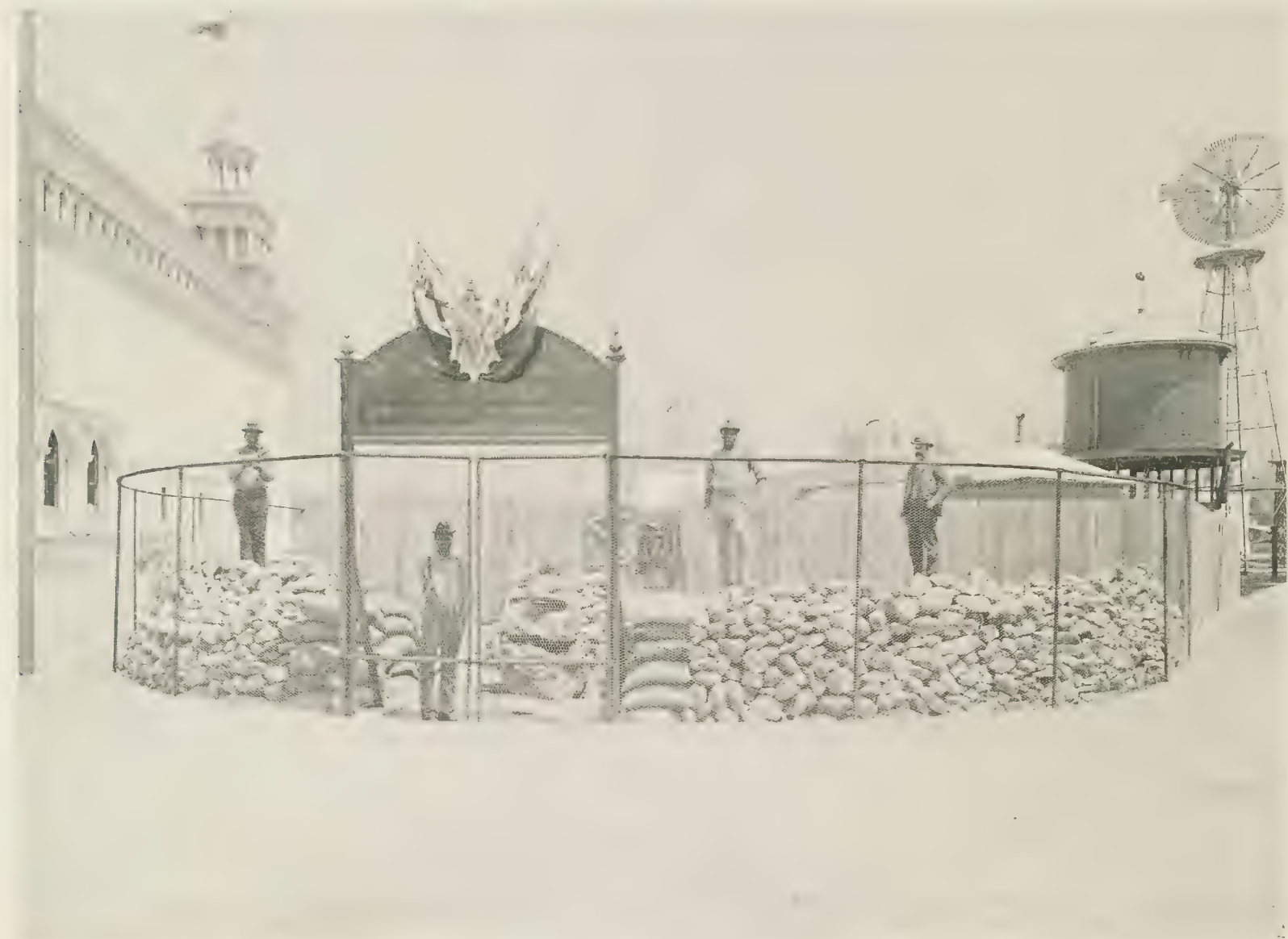
Nowhere in the hall of Mining is there a more attractive spot than the Cape Colony section, south of the Brazilian exhibits; for here of an afternoon, between the hours of two and four, is shown the process of diamond washing from soil imported from the richest deposits of the Kimberley mines. To Americans this should be of special interest, for by the United States are purchased considerably more than one-half of the \$20,000,000 worth of diamonds annually produced by this famous district, almost entirely by a single company, whose rate of production is thus restricted only to maintain the market value of its output.

The section is surrounded by a high partition, with plate-glass windows, within which the earth is scattered as found in the mines; but a better view of the processes of washing and cutting may be obtained from



CAPE COLONY DIAMOND MINES

from a single pan of earth. The rough diamonds are then delivered to manipulators for cutting and polishing, and are thus prepared for market, losing about half their weight through these processes, of which the latter is performed by a revolving plate making 2,000 revolutions to the minute. In a glass case are rough diamonds valued at \$750,000, including all colors, forms, and degrees of crystallization, from deep brown to purest white, and with many intermediate shades, as blue, green, pink, and orange-yellow. There are also the black diamonds used for cutting, the hardest of all varieties, and such freaks of nature as the twin diamond, the latter exceedingly rare. Other exhibits from southern Africa are specimens of copper ore from Namaqualand; asbestos, whose fibres are of a bluish tint; and a cabinet of minerals collected in the region south of the Zambesi river.



A DIAMOND MINING DISPLAY

In the eastern sections of the hall, and extending into the area occupied by the states, is a large display of mining machinery of many patterns and many purposes. The most extensive exhibits are by Fraser and Chalmers, the Chicago Iron works, and the Gates manufactory, all of Chicago, the specimens from the first of these firms being among the most massive in the building. An imposing structure is the so-called Chilean mill for the crushing of gold and silver ore, its ponderous rollers, as they revolve upon their axis, having also a horizontal rotary motion within the huge metallic die. This is a sample of the score of such mills now in operation in Mexico and the United States, and its companions in this section are several huge quartz mills, a lead furnace, rollers for such fine work as the crushing of diamond bearing earth, and a large assortment of apparatus for the reduction and refining of copper ores. Of the latter mineral, there is a compartment filled with many beautiful specimens, the company also showing samples of a recently discovered alloy, known as ferro-alumina, which is claimed to be the strongest and hardest metallic substance known, and is specially valuable for such castings as the shoes and dies of stamp mills and rock crushers. In the section occupied by the Chicago Iron works are apparatus for crushing quartz, for smelting ores, and for hoisting and pumping, while across the aisle is a crushing plant, installed by the Gates company, including a leviathan rock breaker with a capacity of 150 tons an hour. In this section is also a model in operation, showing the processes of crushing, elevating, screening, and distributing stone used for paving or ballasting.

Elsewhere are various mills for the grinding of rocks, ores, and all other refractory materials, their chief distinction consisting of the various motions with which the rollers work in their dies. Many of the machines are arranged for either wet or dry grinding, some of them stationary, and others portable. There are also

mills which serve both as pulverizers and separators, with apparatus specially designed for the preparation of paint materials.

The collection of drills is an interesting feature, the machines being of all sizes and makes, one of them for boring to a depth of a mile or more. Elsewhere is apparatus for sawing and polishing stone, contributors

from the eastern and middle states being foremost in this display. Another group consists of chain belting and appliances for elevating and hauling minerals. Of this class the Jeffrey manufacturing company, of Columbus, Ohio, is a prominent exhibitor, its section containing, besides a large assortment of machinery, a model showing a section of a coal vein. Illustrating the method of moving ores and coal, is an underground haulage plant, in a tunnel beneath the southern portion of the building, composed of a wire-rope tramway, cars, and engine furnished by several companies. At the further end of the hall, on the ground floor, is a system of iron pipes, representing an invention whereby it is claimed

great saving of time and money would result from conveying minerals in semi-liquid form from mine to market, pulverized, mixed with water, piped, and then, after reaching their destination, pressed into solid cakes.

In the machinery department are also exhibits of metal manufactures. Ploughs, rails, fence-wire, and other forms of iron and steel are displayed by a Pennsylvania company, the key-stone state being further represented by two tasteful pavilions of sheet iron, one of them surmounted by a golden eagle. In the official classification these exhibits are grouped under the head of the metallurgy of iron and steel, while under the



KIMBERLEY, SOUTH AFRICA, EXHIBIT



GENERAL VIEW LAGOON



THE AGRICULTURAL BUILDING FROM THE SHORES OF THE GRAND BASIN

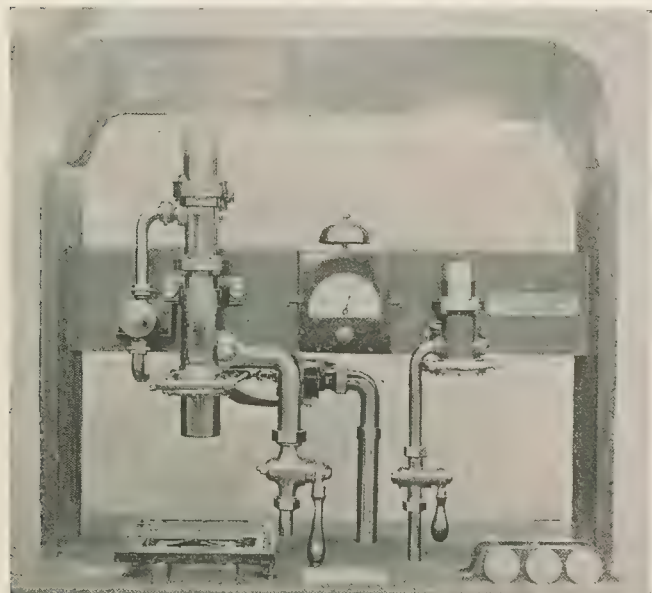


ASBESTOS THEATRE CURTAIN. SUBJECT: READING HOMER

same substance, one considered as nearly fire-proof as textile fabrics can be.

Near the German section, in the southwestern entresol, is the general exhibit of ores and other minerals, with an exposition of the modern processes by which the metals are extracted and transformed into commercial products. Along the central aisle, as a supplement to these object lessons, is a series of small transparencies, copies of cotemporaneous illustrations depicting the ancient and primitive workers in metals of all countries, with their rude apparatus and environment. The entire exhibit is the creation and special pride of the chief of the mining department.

In the copper and tin section are illustrated, by photographs and specimens, the dry and wet processes of reduction, the tin of South Dakota and the copper of Montana



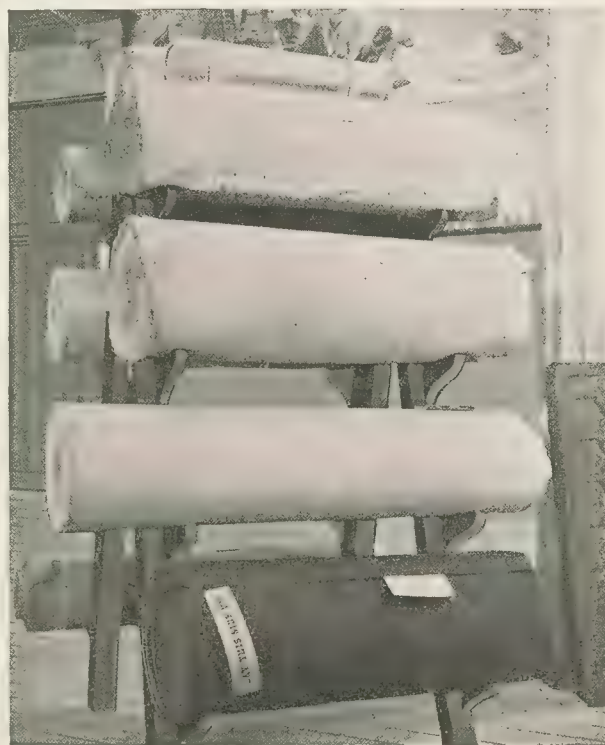
SLUICE VALVES

being plentifully displayed in their crude forms. A company whose specialty is the refining of copper also shows its method of decomposition by electro-medical agencies.

It is in this vicinity that Arthur C. Wendt, a New York engineer, shows the first of the many photographs which he has distributed almost throughout

the entire department. Here are reproduced the works that he has erected at Antofagasta, Chile, for the crushing, smelting, and

class designated as copper and its alloys is the pavilion constructed of brass and copper tubes by Randolph and Clowes, of Waterbury, Connecticut. The latter stands at the eastern entrance to the building, across the hall being the golden trophy symbolic of Russia's mines, and between the two the great shaft of coal from Pennsylvania. Coal is also, as I have said, at the base of the monument in the northern end of the hall, representing the mineral production of the United States for each second of time, with asbestos at the apex of the structure. But among all the forms of mineral manufacture there are none more striking than those exhibited by the H. W. Johns Manufacturing company of New York. In a tasteful pavilion the firm has a display of raw asbestos, showing also their looms in operation, with felt in various shapes, a fireman clad in garments of asbestos, and a miniature theatre curtain of the



ROLLS OF ASBESTOS FELTING



NEEDLE OF ANTHRACITE COAL, PENNSYLVANIA

displayed by a New York firm as an anti-friction compound. It is generally admitted, however, that aluminium in some form is the coming metal of the world, and to this has been allotted a liberal space side by side with the groups of iron and steel. Aluminium is shown in composition with iron, gold, ferro-manganese, tin, and copper,

refining of silver and copper. The Huancha company, by whom he was employed, is now one of the largest private producers of silver in the world, with a yield from its mines, since 1877, valued at more than \$43,000,000. The plant at Antofagasta includes nearly 60 furnaces, of which two are for the refining of silver, with many huge copper pans and settling tanks.

Among these groups a New York firm presents a collection of rare coins, and of cruder forms of metals, with their alloys. Another New York company has a complete assortment of metallic nickel, salts, and alloys, while a Virginia factory shows artistic forms of zinc. Elsewhere, in photographs and models, the methods of extracting gold and silver by modern leaching processes are fully explained, the Russell company of Park City, Utah, making the largest and most interesting display. Its process is distinguished from the old leaching method by the use of bluestone in the hyposulphite solution, and of soda ash as a precipitant for lead. This may be applied to free and rebellious silver ores, and to silver-gold ores and tailings, either in the raw state or after roasting, and has been adopted by various mills in Mexico, Montana, Utah, and Colorado. Whatever its merits as compared with other processes, many expert metallurgists claim that the extraction of gold and silver by lixiviation, or leaching, will eventually supersede both the smelting of ores and the separation of the metals by amalgamation with the use of mercury as a dissolving agent.

Among the exhibits of antimony and mercury, the quicksilver of New Almaden, California, and cinnabar ores from the golden state form the basis of the collection, most of the remainder coming from eastern firms. In this class is included the new metal called electricon,



GENERAL VIEW OF LAGOON



ON WOODED ISLAND

as well as in many manufactured products, a reduction company of Pittsburg, Pennsylvania, occupying the largest space in this section. There are several exhibits on the ground floor which illustrate the metallurgy of iron and steel, including those which show the methods of manufacturing crucible and open hearth steel, the different forms of sheet iron and steel, steel castings, and projectiles. In the gallery are more compact displays, explanatory of these and such other branches as the chemical process of puddling, with mineral wool in all forms, furnace slags, samples of welding, and specimens of tools whose heads are finely tempered.

Beyond the metallurgical department, in the south gallery, is a library containing publications of interest

to the mineralogist, with a collection of photographs of eminent men in the domain of this practical science. Midway in this gallery is a large pavilion, in and around which American manufacturers of tin and terne display their wares; and in the southeastern corner are assaying and testing laboratories. A Pittsburg company shows chemical substances for the testing of minerals, and adjoining its compartment is that of a Chicago establishment, containing furnaces, blow-pipes, and other apparatus, in the operation of which heat plays the leading part.

Except for a few mineral cabinets from the eastern states, and miscellaneous collections from California and New Mexico, the southeastern galleries are virtually monopolized by the exhibits of Ward's Natural Science institute of New York. To describe



SCENE ON THE BEACH



DISPLAY OF STANDARD OIL COMPANY

said to be the largest ever mined in a single piece. Another remarkable collection is contained in flat cases along the central aisle, including several hundred gems and ornamental stones, the more precious varieties represented by actual specimens or by models in glass, showing the exact color of the originals and the forms in which they are usually cut. There are similar models of the celebrated diamonds of the world, comprising fac-similes of fifteen historic gems, from the Polar Star, weighing 40 carats and belonging to the Russian princess Youssouppoff, to the Koh-i-noor of the British crown, and the immense stone in the possession of the Great Mogul, said to weigh 297 carats. Of meteorites there is a large collection, and another interesting exhibit is that which explains the structure of the earth in specimens and geological models, the latter showing not only the order of stratification, but the principal features of erosion and displacement.

The most noteworthy collections in the northeastern and northern galleries are those which consist of coal, coke, and petroleum. The northern entresol is mainly occupied by the Standard Oil company, which has transformed it into a pavilion, its walls and ceiling of a delicate cream color, with decorations in gold. At either end of the section is a minor pavilion, surmounted by a cupola, within whose colonnade is a female figure holding aloft a lamp of antique design. Along the front is a geological representation of the oil producing districts in New York and Pennsylvania, and against the windows at the rear is a large galley of beautiful transparencies showing the manufactories of the company in Philadelphia, Whiting, and Lima, and its facilities for piping and transporting by steamer and railroad. In one corner is a pyramid of miniature oil barrels, representing the daily product; elsewhere are models showing apparatus for refining, and everywhere are glass vessels filled with petroleum of various grades, and for many purposes. The collection of lamps ranges from the tiniest specimens to such as are used in lighthouses; and in one of the pavilions to which reference has been made are some magnificent specimens of richly ornamental metal and porcelain. In show-cases, built into the outer walls, are others of less elaborate design, with those typical of various

this collection in detail would be simply to review the entire domain of geology, with its kindred department of mineralogy. There are several collections, however, of which special mention should be made. Besides many specimens of the precious metals, there is a case containing casts of gold nuggets which have become historic, the list including the Welcome nugget found at Ballarat, Victoria, in 1858, weighing more than 2,000 ounces, and valued at \$41,000; the Viscount and the Viscountess Canterbury, both also from Victoria, unearthed in 1870, and valued respectively at \$21,000 and \$17,000; the Precious, discovered during the succeeding year in the same district, valued at \$31,000; the gold nugget taken in 1842 from the Ural mountains, Siberia, weighing 100 pounds and worth \$22,000, and the mass of platinum, weight 21 pounds, found there in 1827 and



ALSEN'S CEMENT PAVILION, GERMAN DEPARTMENT



VENETIAN BOAT IN LAGOON

the location of mines which produce such varieties as gas, smithy, steam, coking, and domestic coals. All the cabinet specimens have numbers corresponding to those on the map, and thus the visitor may ascertain at a glance the varieties of coal produced in each locality.

Near by are many collective exhibits which here need only the briefest mention. Among them are building and ornamental stones, the New England states, New York, South Carolina, Iowa, Illinois, and Colorado showing samples of their granites and slates, while a firm doing business in the empire state has erected a pavilion for the display of Mexican and Californian onyx. Beyond this are all the substances known to manufacturers for grinding, abrading, and polishing, including emery, pumice, corundum, and a compound

countries, one of the latter being an oil lamp used in northern India long before the Christian era.

In the northeastern galleries the Frick Coke company of Pennsylvania reproduces its plant in a series of models, a portion of the miniature machinery being operated by electric power. In the centre of the section is the name of the company, in letters of coke, and upon a huge pile of that material is the inscription "41,000 tons daily."

Many months ago a veteran miner, named Boyce, undertook the task of collecting, for exposition at the Fair, samples of coal from the great producing districts of the United States. The result is displayed in a large number of cubes, contained in cases, which form the enclosure of a small section adjacent to that of the Frick company. The greater portion of the space is occupied by a map of the United States painted upon panels of glass, and showing



MACHINERY HALL FROM THE COURT OF HONOR

known as carborundum, composed of silica and carbon combined by an electrical process. Wheels made of this substance are claimed to be the hardest of cutting apparatus, and are especially valuable for polishing diamonds.

In this vicinity are also various exhibits of graphite, and crucibles made of that substance, including collections from several of the oldest manufacturers in the United States. In one of the sections is a solid block of graphite from Ceylon; weighing more than 260 pounds. Cements, asphalts, and artificial stones are arranged in many attractive forms, several of them in ornate pavilions, as those of the Warren Chemical and Manufacturing company and the Barber Asphalt company, of New York,

and the Acme Cement Plaster company, of Salina, Kansas. Samples of natural asphalt are shown from the lake of pitch on the island of Trinidad, with an artistic model of that natural curiosity. At the northern extremity of the eastern entresol is a comprehensive assortment of sulphur, saltpetre, brimstone, and mineral waters, mainly furnished by New York companies, with a large relief map of that state, and a smaller one of the West Indian isle of Navassa, noted for its extensive deposits of sulphate. Close at hand is the only collective exhibit of salts in the Mining hall, with specimens from New York, West Virginia, Ohio, Michigan, Kansas, Texas, Utah, Nevada, and California.



J. A. YERINGTON, NEVADA

WORLD'S FAIR MISCELLANY.—While, as in other departments, exhibitors, whether of machinery or processes, must be their manufacturers or inventors, they might be represented by an agent appointed for the purpose, subject to the approval of the director-general. With all specimens of ore must be given a brief description of their character and of the location of the deposit, with a rough analysis, and, at the discretion of the exhibitor, such other data as might be

of general interest. No blocks of ore or coal must exceed three feet in diameter, except by special permission, and for slabs of marble, artificial stone, etc., the limit was four feet square of surface.

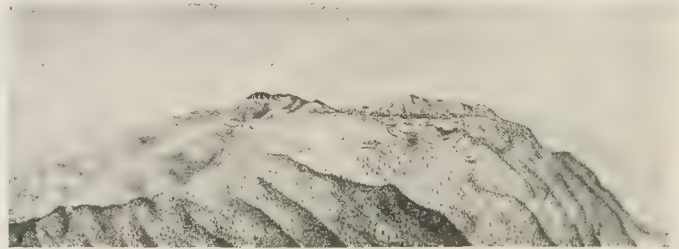
The 28,000 pound block of coal contained in the British section is said to have cost more than \$5,000 to place it in the Mining hall, or at the rate of \$357 a ton. To hew it out and hoist it to the surface was a nine months' task, rails being laid through the galleries of the mine, and a long steel car constructed to haul it to the shaft. Several tons of earth were removed from this specimen before it was forwarded to the Alexandra docks at Liverpool, and thence conveyed to Jackson park.

The silver contained in the statue of Justice in the Montana section was extracted from native ores at various smelting works throughout the state, the entire mass being melted in a crucible at Grand Crossing, and poured into a mold more than eight feet in length. To construct a mold which would reproduce an exact counterpart of the model, fashioned in plaster by Parks, and to cast the figure without flaw or blemish, was a task of no slight difficulty. This was finally accomplished during the month of March, though for several weeks before expert founders had been at work. The molten metal was carefully poured into the mold in the presence of a number of invited guests, among whom were the presidents of the National Commission and the Chicago board. The figure, swathed in cotton batting and woolen cloths, was brought to the Mining hall on a truck in a long, low, coffin-shaped box, and was thence removed by a derrick and fifteen stout laborers to the floor of the building, from which it was hauled by windlass and crow-bars to the Montana section. The statue was unveiled on the 30th of May.

In connection with the exhibit of diamonds from the Kimberley mines in Cape Colony, it may be mentioned that, since their dis-

covery in 1867, several tons of diamonds have been exported from that country, representing a money value of \$500,000,000. The field is now virtually absorbed by the De Beers company, which, for the four years ending June 30, 1892, produced 7,421,000 carats' weight of diamonds, worth more than \$50,000,000, paying annual dividends of 10 to 12½ per cent on an invested capital of nearly \$20,000,000. During the last of these years there were washed 3,240,000 loads of earth, yielding 3,035,000 carats, valued at about \$19,000,000, the dividend declared amounting to nearly \$2,500,000. While there are some large and valuable stones in the Cape Colony exhibit, none will bear comparison with the large orange-yellow, double-deck brilliant displayed in the Tiffany collection in Manufactures hall.

The deposit of rose-garnet, mentioned in connection with the Mexican exhibits, was discovered by one Niven of New York, a mineral prospector of scientific attainments. A specimen forwarded to New York was pronounced to be the best ornamental stone of modern times. In an article on the Columbian Exposition in the *Berlin Zeitung*, Julius Lessing describes it as "a gray marble containing garnet-red masses which have every appearance of costly inlaid mosaic work, all varieties of color, from deep red to the most delicate yellow and milk white, appearing in the same block." Laboratory tests have demonstrated its hardness, strength, resistance to extremes of temperature, and other valuable properties as a building stone.

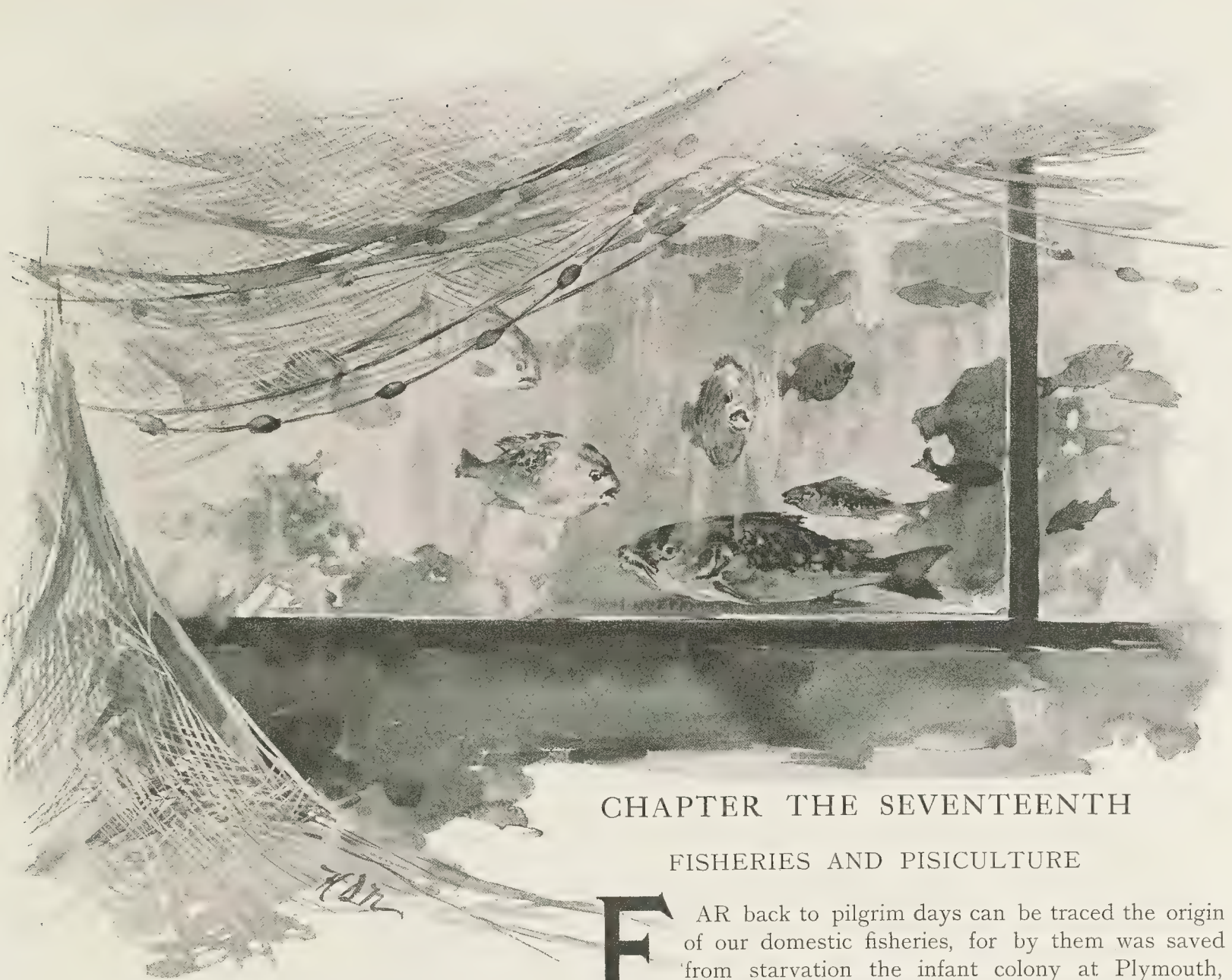


VIEW OF THE WEST SIDE OF TREASURE HILL

After the close of the Fair it was intended to present the Idaho state collection of minerals to her university. An offer made for it by the university of Chicago was declined. The ruby sand, mentioned in the text as one of Idaho's exhibits, is contained in small vials, and came from the Neal district. At first sight it does not appear to differ from common sand, but when closely inspected red and brown particles are observed, shining like rubies. These form the metallic base of the earth known as zirconia, and are worth more than thrice their weight in gold. In Washington county, Idaho, there are places where zircon sand exists in paying quantities, and at Baltimore are the only works for its reduction.



COLUMBIAN CHAIR BOYS



CHAPTER THE SEVENTEENTH

FISHERIES AND PISICULTURE

FAR back to pilgrim days can be traced the origin of our domestic fisheries, for by them was saved from starvation the infant colony at Plymouth, and by their proceeds were supported the first public schools established on New England shores. Some two years before the *Mayflower* bore westward the fathers of the republic, a company of Puritans, returning from their sojourn in the Netherlands, besought King James for permission to found an American colony. "What profit might arise," inquired his majesty. "Fishing," was the answer, in a single word. "So God have my soul, 'tis an honest trade; 'twas the apostles' own calling." Such was the monarch's decision, and so the permission was granted.

Except for despatching a ship in 1624 to establish a fishing station at Cape Ann, the Plymouth colony took no active part in the earlier development of American fisheries. This station they abandoned after a single season, and, as is related, their vessels, "well laden, went joyfully home together, ye master of ye larger ship towing ye lesser ship at his sterne, all ye way overbound." Meanwhile had been shipped from that point, in the previous year, the first cargo of fish for European markets. Thenceforth the industry grew apace, until, at the outbreak of the revolutionary war, there were more than 500 fishing craft belonging to Massachusetts ports alone, their total catch being valued at \$750,000. Then came further troubles, followed by the war of 1812, and almost from that date until the settlement of the Bering sea controversy, progress has been retarded by foreign complications and injudicious legislation. Many a time has the remark been made that "our fishermen are always bringing trouble on the government." Rather should it be said that the government is ever bringing trouble on our fishermen. But notwithstanding all obstacles, the yield of fisheries has attained to mammoth proportions, and now for the first time in the annals of international expositions, this industry, with all its adjuncts, finds adequate representation in a home of its own.

In the Fisheries division of the Fair are included many branches, in addition to such as relate to the quest and capture of animals and plants whose home is in the water, entirely or in part. In the official classification are included fish and other forms of aquatic life; sea fishing and angling; fresh water fishing and angling; the products of the fisheries and their manipulation, and fish culture. In addition to the United States are represented nearly all nationalities among whom fishing is a prominent industry, from New Brunswick to New South Wales, the harvest of sea, river, and lake, "gathered," as has been said, "in wasteful fashion from a crop that is neither sown nor tended," amounting annually to more than 2,000,000 tons, and affording direct employment to at least 1,000,000 men and 200,000 vessels. In the United States the take of fish exceeds 250,000 tons a year, of which about one-fourth comes from the waters of the great lakes, with a large production from Atlantic and Pacific grounds, while the whale and seal fisheries still produce largely, though with a steadily diminishing yield. As to the fisheries of other lands, brief mention will be made in connection with their exhibits in this department.



FISHERIES BUILDING, FROM WOODED ISLAND



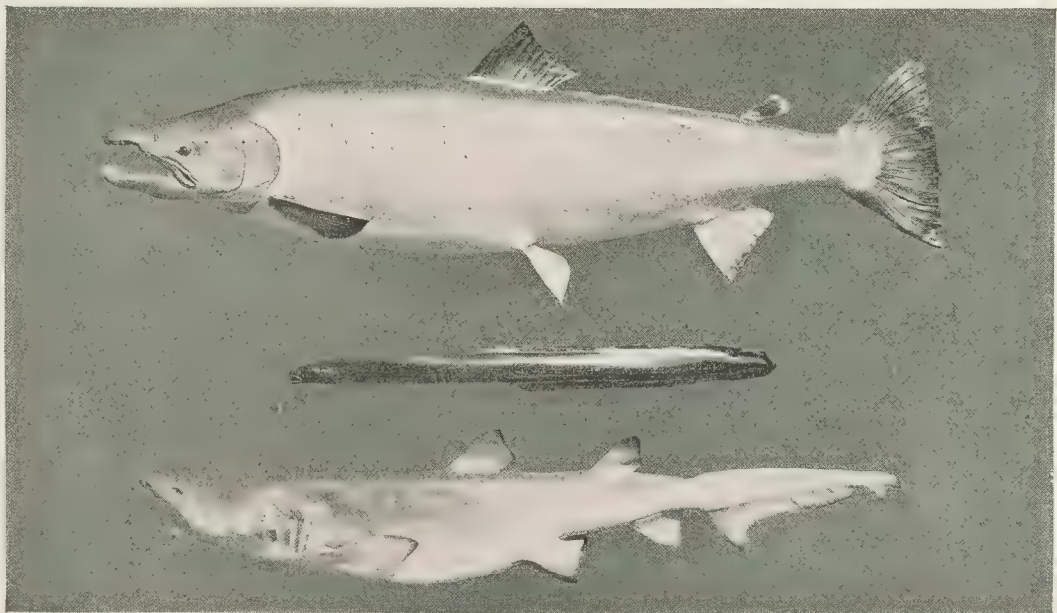
FISHERIES BUILDING

Facing in front an arm of the lagoon by which it is separated from the government building, and with one of its polygonal annexes bordered by a miniature estuary opening into the lake, the Fisheries pavilion raises its clear-cut outlines against the sky. In the fantastic design of this edifice, or rather group of edifices, we have somewhat of a relief from the architectural classicism of its environment. By his brethren of the craft, this composition, with its opulence of decorative features, conceived by Henry Ives Cobb, has been pronounced "an architectural poem." However this may be, it is certain that Mr Cobb has given us a structure admirably suited to its several purposes, one that, in treatment, not only departs from the conventional style of its neighbors, but, as with the Horticultural hall, is of itself an illustration of the uses for which it was built.

In the main edifice, devoted to fisheries in general, to pisciculture and scientific investigation, we have a rectangular structure of no special order of architecture, though based on the southern Romanesque, in length 365 feet, with a width between the entrance of 242 feet, and between the outside walls of about two-thirds of the latter space. Through the centre runs a spacious hall, 280 by 80 feet, lighted by clear-story windows, and around which is a continuous aisle, occupying the remainder of the floor space. Above are galleries, also encircling the entire structure, and increasing its exhibiting space

to a total of 60,000 square feet. To give accent to its low, long curtain walls, the roofs, of glazed Spanish tile, were so constructed as to slope sharply to a central ridge. Surmounting them is a circular tower, over the centre of the nave, in diameter co-equal with its width, and around which are turrets, with staircases leading to the gallery and to an exterior balcony. Above the tower is a clear-story stage, also flanked by turrets, and above all, rising to a height of 150 feet, is a conical roof, capped with a belvedere, around the base of which is still another gallery. At the principal entrances, in the centre of the main façades, are pavilions projecting from the outside walls, adorned with sculpture work and statuary typical of the fisherman's craft. In the entire structure, with its double row of columns, their capitals depicting in endless groups all forms of life contained in sea or river, we have rather a playful delicacy than such grandeur of design as some might deem in keeping with its proportions. In this and other points the Fisheries buildings differ essentially from most of their neighbors; but with a difference to which none but the most captious of critics will take exception.

In preparing his decorative scheme, the architect has produced some four-score models of columnar ornamentation, each of different and yet of conventional pattern. If in many of them there is found a strong element of the ludicrous and grotesque, it is only in keeping with the playfulness of design, and by no means detracts from the merit of composition. Rather does it serve, as one of his confrères remarks, "to make it



SALMON. EEL. LAND SHARK

joyous and festive, without loss of dignity, grace, and fitness." Perhaps in none of the Exposition buildings have their artificers displayed a more striking originality of treatment, and that without treading on the dangerous ground of inventing new forms of architectural expression.

East of the principal edifice, in the direction of the lake, is the aquarium building, connected with it, as is the one devoted to angling exhibits, by a curved projecting corridor, so that the Fisheries hall appears to set back from its two flanking pavilions. The latter are of octagonal shape and somewhat similar design, the one containing the aquaria with clear-story windows and glass-roofed circular aisles in concentric arcs, surrounding and connected by arcades with a central rotunda, where, from the crevices of moss-covered rocks, rise jets of water in miniature fountains, descending in spray to the basin below. Here is a choice collection of aquatic plants, and of goldfish and other ornamental specimens. In the salt and fresh-water aquaria, which are ten in number, are displayed nearly all the known varieties that people sea or river. As to the dimensions of these aquaria, it need only be said that their capacity ranges from 7,000 to 27,000 gallons, and with a total of 140,000 gallons, apart from reservoirs and water circulation.

Southward, the main façade of the Fisheries hall faces toward the Government building, in the northern end of which are the exhibits of the United States fish commission, thus grouping in one display all the wonders of the great deep, and including river fisheries, pisciculture, and other branches presently to be mentioned. While at several of our great world's fairs there have been similar collections on a smaller scale, they have for the most part been scattered among other departments, and therefore wanting in unity and expression. Here, in accordance with the clause in the congressional act which provides for an exhibition of "the products of soil, mine, and sea", is for the first time afforded an ample and continuous illustration of aquatic industry and science. Nor is there any good reason why this industry, aptly termed the mother of commerce, and in many

countries a prominent source of wealth, should not be fully represented at the Columbian Exposition. Still more appropriate would appear the emphasis given to this division, when it is remembered that fishing was one of the favorite pursuits of the native races of America,



HERRING FISHING IN NORWAY

and that to their conquerors the pearl fisheries of the Isthmus were prizes coveted more eagerly than gold itself.

In the department of Fisheries is not only displayed in complete and interesting form their present condition, whether from a scientific or commercial point of view, but in a series of object lessons is portrayed their history for at least four centuries of the past. Almost side by side are the primitive apparatus of the savage, and the most approved appliances and methods evolved by many cycles of scientific progress. Here also are the laws and regulations, the reports and statistics, pertaining to fisheries. As to the fish themselves, there are few species that are not here represented, from the minnow to monsters of the deep, with river and shell fish of every kind, and with fish-eating birds, mounted on frames or preserved in alcohol. Of fish and fish stories described on canvas there is no lack, many of them depicted by artists of more than national repute.



HOOKS AND LINES.



EXHIBIT OF FISH NETS.



INTERIOR VIEW FISHERIES BUILDING

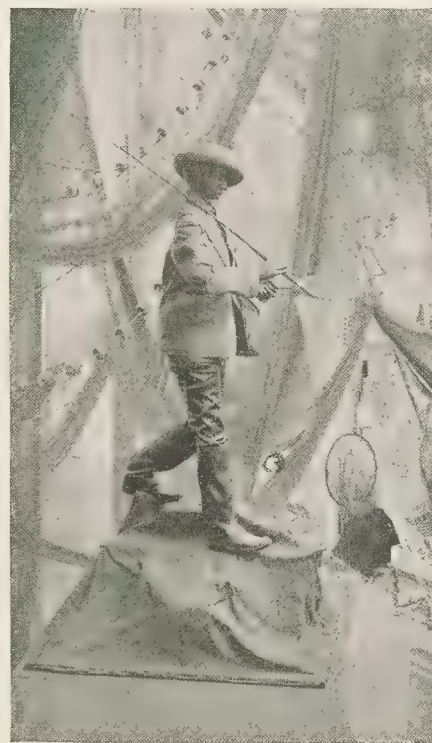
In the angling department is a long array of rods, reels, tackle, and other appliances, showing the progress made in its various branches, and such as of itself forms a history of the pursuit which Walton ranked among the liberal arts. Of flies there are several exhibits, among the most interesting of which is the process of their manufacture by men and women actually at work on these delicate fabrics. Other kinds of artificial bait are also displayed in great variety; and near them is a collection of all such articles as pertain to the angler's outfit, while on the banks of the lagoon, in close

proximity, are fishermen's camps, constructed of logs or canvas.

The centre of attraction is the exhibit of live fish in the aquarium building, where in tanks arranged in concentric circles is the largest collection of sea and fresh-water specimens in the world, except for the one contained in the Brighton aquaria on the southern coast of England. This was contributed by the United States fish commission, whose object was to present the best possible picture of fish-life, especially of the interior waters of America, and at the same time to illustrate the operations of the commission. While seeking to make it of educational value, everything has been done to show the different species in the most attractive form. That this is one of the most popular departments of the Exposition is attested by the crowds which daily inspect the many odd-looking specimens brought from ocean's depths and inland streams. To young and old it has proved a delight, and is studied by thousands who have never been within sight of ocean, and to whom the stories of the great deep are as the marvels of tradition.

The first point of interest is the pool in the centre with its gold fish and other bright hued specimens. The groups of stalactites from which a supply of fresh water is constantly dripping into the basin are in tasteful design. Here also are numerous specimens of rock, marine vegetation, and mounds of aquatic and semi-aquatic plants. Between the central basin and the circles of tanks are passage-ways six feet in width, the tanks numbering 50 in all, of which about two-thirds contain the fresh-water species to the right of the southern portal. They vary in length from six to 50 feet, with a total glass frontage of nearly 600 feet, and with 3,000 square feet of surface. Their decorations resemble those where the gold-fish are domiciled, with miniature mountains and caves made of a lime-like substance, called calcareous tufa, from the springs near Toledo, Ohio, while vegetable matter coated with limestone is wrought in fantastic designs. In building these tiny grottoes and reefs, a dark cement has been used, and the holes and corners are filled with dark earth, in which aquatic plants are deposited.

In the fresh water sections are all the species inhabiting the great lakes, rivers, and their tributaries throughout the United States. Here are beautiful specimens of lake trout, brook trout, rainbow trout, carp, tench, pike, black bass, many kinds of suckers, cat-fish, dog-fish gars, and minnows. Of gold-fish, the most attractive are the Chinese variety, with fan-like transparent tail, while the most handsome tank is that which contains the golden ide, of the carp family, indigenous to European rivers. In an aquarium 70 feet long by 12 in width are shown the largest specimens of the Mississippi basin and the great lakes, as the sturgeon, pickerel, cat-fish, white-fish, and bass. From inland waters are also the shovel-fish, lake herring, buffalo-fish, perch, and others. Then there are separate tanks for all fish indigenous to the Atlantic slope east of the Alleghany mountains. Here are in full splendor every species of edible and



CANADIAN FISHER BOY

commercial fish, with almost all the curious and hideous specimens in the waters of the United States, as well as a vast number of foreign species. There are the von behr from Germany, and the Lochleven trout from Scotland, as well as rainbow trout from California, black spotted trout from the Rocky mountains, and brook trout from every mountain stream in the republic. The different varieties of carp occupy a separate tank; and in this collection a most interesting fish to naturalists is the spoon-bill, or paddle fish, the only

species of the genus, and the only genus of the family polyodontidæ in the world, and one that has never before been successfully preserved in an aquarium. In addition to aquatic plants, the fresh water tanks are well supplied with all kinds of water life, old logs being planted across the crevices, not only for the benefit of the fish, but to give to the surroundings a realistic appearance. The special design has been to make the environment in all cases correspond as far as possible with the habitat of the occupant, both as to fresh-water and marine exhibits.

The marine collection has been gathered from great distances, ranging from Atlantic to Pacific shores.



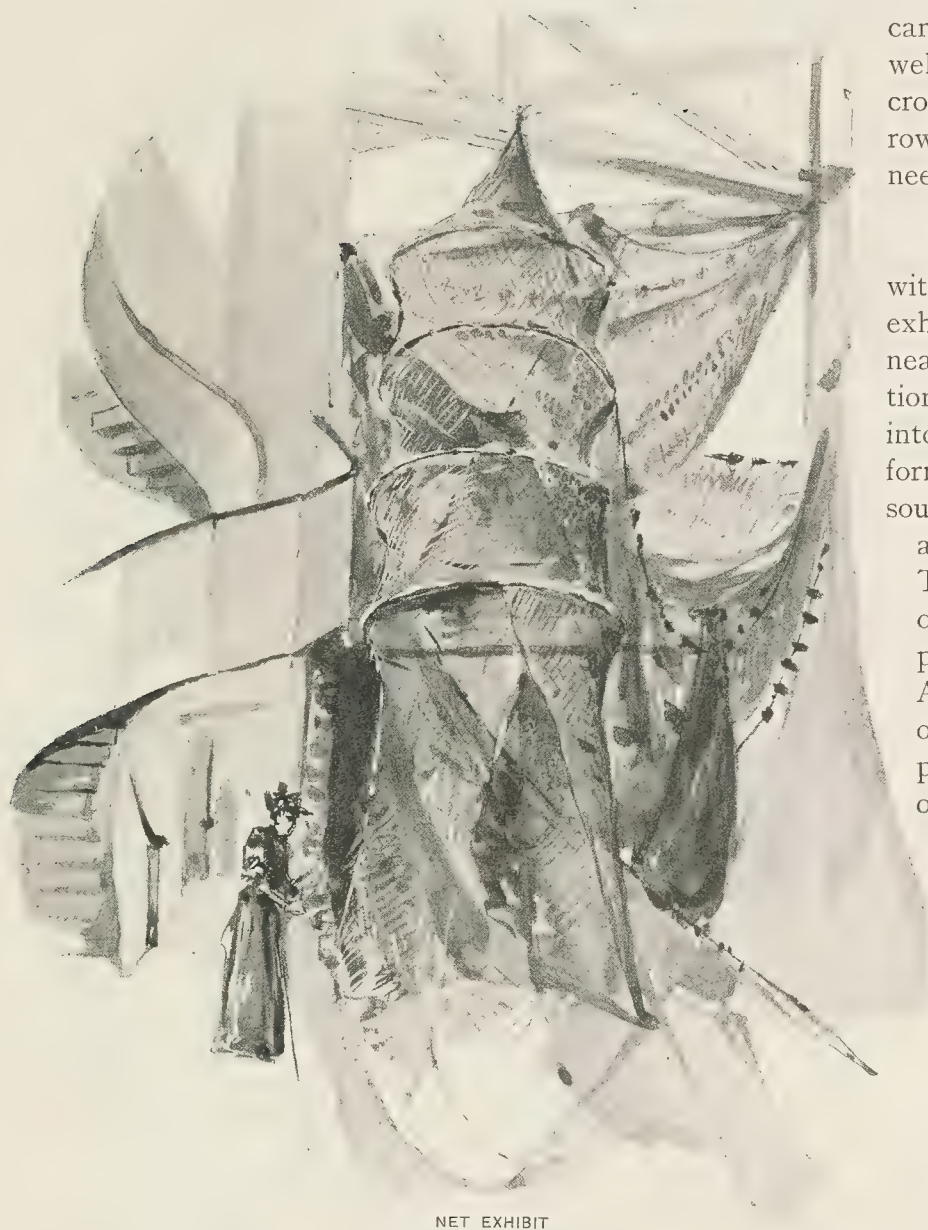
HORSE MACKEREL



FISH NETS

Three classes are represented; food, ornamental, and monster fishes. Tongued cod, spotted croaker, pompano, tautog, sheeps-head, toad fish, sea robins, sharks, skate, porgies, and mummichogs are among the specimens of every important species known to science. Divers have searched the ocean for the rare forms of plant life which adorn the tanks, growing as in their native beds. Resting placidly on rocks and sands are crabs, lobsters, turtles, sea anemones, terrapins, snakes, and other invertebrates. Elsewhere are shrimps, snails, whelks; and there is a collection of such varieties as the sea-horse, trunk-fish, and puff-fish, the last the most repulsive in all the marine aquaria, covered with sharp spikes similar to the porcupine-fish. A peculiar specimen is the so-called nursing fish, with a wavy appendage several feet in width.

The fresh water specimens are supplied with filtered water, kept at a temperature to suit their natural habits. The salt water is conducted in rubber tubes to a filter placed in the cellar and containing stones, gravel, and sand as in nature, and is then run off into a cistern with a capacity of about 60,000 gallons. A duplicate set of pumps operated by electric dynamos drives the water into a reservoir at the top of the building, whence it flows back into the aquaria. The stream carries enough air with it to aerate the water and enable the fish to breathe. Another method of aerating is by aquatic plants, which are continually giving off oxygen, and absorbing the



NET EXHIBIT

carbonic gas generated by respiration. The fish are well fed, and thrive better than could be expected, crowded as they are in cruel fashion within the narrowest of space, in a collection that appears to be needlessly duplicated.

In the main Fisheries building we will begin with one of its smallest and yet most interesting exhibits. This is contained in a small glass case near the southern entrance, and consists of a collection of shells, fashioned by a Memphis contributor into pansies, bouquets, bracelets, and other fantastic forms. Thence extends along the main floor and the southern gallery, the largest display of nets, seines, and twines that has ever been brought together. This is by the American Net and Twine company of Boston, in the centre of whose enclosure is a pavilion containing an infinite variety of specimens. A portion of the enclosure is covered with a net of ample proportions, beneath which is a miniature pound net, resembling in pattern such as are used on the great lakes, and a large assortment of gill netting. Spanish cast netting, herring nets, trawls, and sundry other articles are suspended here and there with decorative effect, and there is a labyrinth of net-work, comprising the English style of cast nets, models of weirs used in New England, salmon traps, and salmon weirs, with fish traps of all description. The entire space is draped with cod hauling seines as used on the Newfoundland and Labrador coasts, and in the rear is an oil painting of a fisherman in the act of hauling in his net. There are also shown by this firm purse seines, and their method of oper-

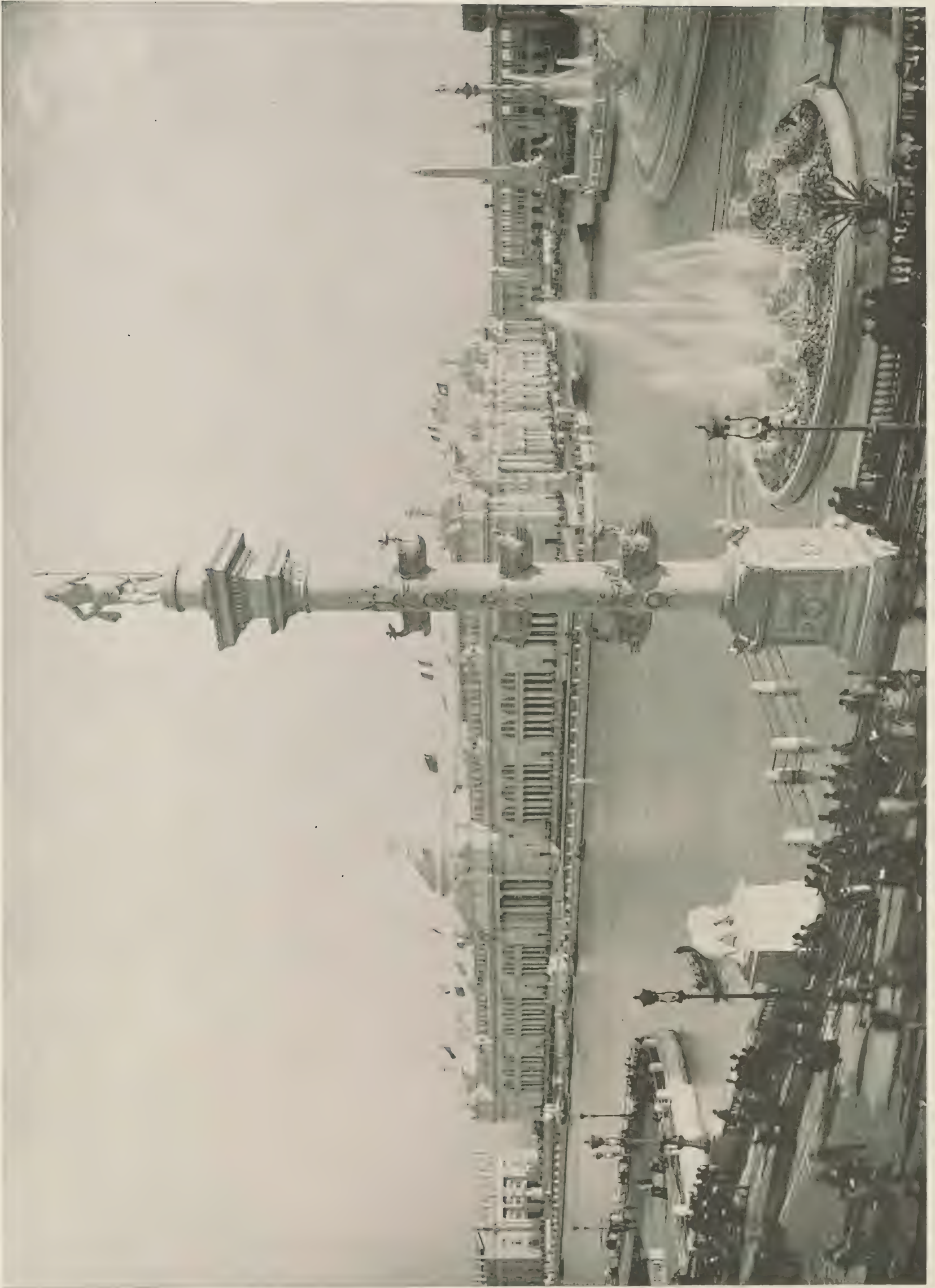
ation, all styles of gill nets, traps, and nets used in the great lakes, models of floating traps, mackerel poaches, and in a word a complete collection of apparatus for the capture of nearly every kind of marine and fresh water fish.

Adjoining the net and twine display, is an exhibit of oyster pails, patent oyster rakes, and similar articles. Another firm has an exhibit of scaling, washing, and weighing machines, and among other contrivances one for shaping, stamping, and weighing fish balls. Near by a Boston lobster firm shows an exact reproduction of a well-smack used for transporting lobsters to market. Through a flat glass casing, made to resemble the surface of the ocean, can be seen the bottom of the boat resting on what appears to be the bed of the sea. The vessel is supplied with windlass, wheel, blocks, and all other appliances for receiving, storing, and transshipping its cargo to the cars, which are lying alongside ready to receive their freight. On the opposite side of the aisle is a collection of sturgeon sounds, described as the "air, or swimming bladder of the sturgeon, skinned and dried, with neither taste nor smell, and therefore the purest article for jellies and other culinary purposes."

In this vicinity is the exhibit of the Boston firm of John R. Neal and company, in which are models of fishing vessels, and a large collection of traps, implements, seines and smaller nets, with a section of a mackerel seine side by side with illustrations of mackerel catching. There is also a large array of pictures illustrating the deep-sea fisheries of New England, with everything that pertains to the catching and curing of haddock, and the capture of cod and mackerel, including the position of the nets in the water, back of which are bunches of sea-weed and other marine specimens. Large maps show the principal lighthouses



GLOUCESTER FISHING BOATS



LOOKING ACROSS THE GRAND BASIN TOWARD AGRICULTURAL BUILDING

from Cape Ann to Cape Cod, and from the latter point to Newfoundland the fishing-banks are distinctly located. Colored photographs reproduce the experiences of a fishing trip, and in graphic art are delineated the privations and hardships of the fisherman. Schooners are depicted amid the wintry seas of the north Atlantic, or lying in port with spars and rigging covered with ice, and with frost-stiffened sails that cannot be lowered.

So also are portrayed other phases of this great New England industry, in which are directly employed some 50,000 men and nearly half that number of boats and larger vessels, the value of the catch being not far short of \$20,000,000 a year. In Boston markets alone were landed in 1892 more than 35,000 tons of fresh fish, haddock forming the greater part of the supply, and next, in the order named, cod, hake, pollock, and halibut. There were also 35 cargoes of frozen herring, while from points between Cape Cod and Nova Scotia were forwarded by steamer and railroad 5,000 tons of bream, flounder, smelt, mackerel, shad, blue-fish, salmon, and other varieties. In the first two months of 1893 the fishing craft of Boston harbor made 1,300 trips, with an average take of 15,000 pounds to the trip, this average falling far below the normal returns, for the winter was one of unusual severity.

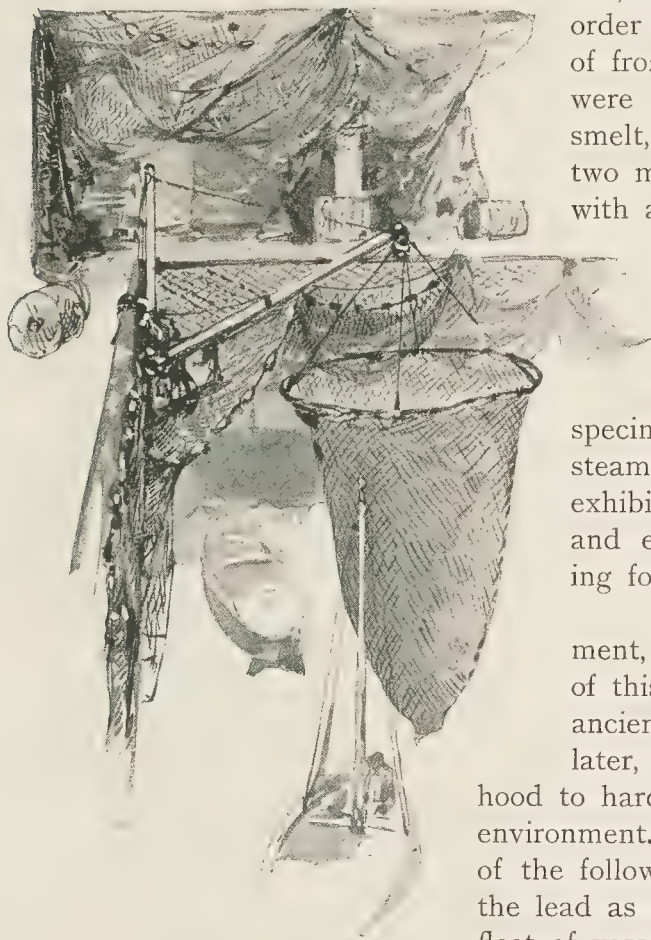
In the southeastern part of the gallery the firm above mentioned has another collection of photographs, some of them representing famous craft among the fishing fleet, and in the centre of its enclosure, the front of which is draped with netting, is a fine specimen of photographic art, its theme representing the United States steamer *Atlantic* saluting the president. While only a private display, the exhibits of this firm present a vivid and faithful picture of New England and especially of Massachusetts fisheries in comprehensive and interesting form.

While as a state Massachusetts has no place in the Fisheries department, Gloucester, the harbor of Cape Ann and one of the largest centres of this industry in the United States, is worthily represented, as befits this ancient New England town. Founded in 1623, abandoned a year or two later, and permanently established in 1633, its colonists, inured from boyhood to hardship and privation, quickly overcame the disadvantages of their bleak environment. In the earlier portion of the following century it had taken the lead as a fishing port, building a fleet of vessels, among them the first schooner that ever sailed the seas,

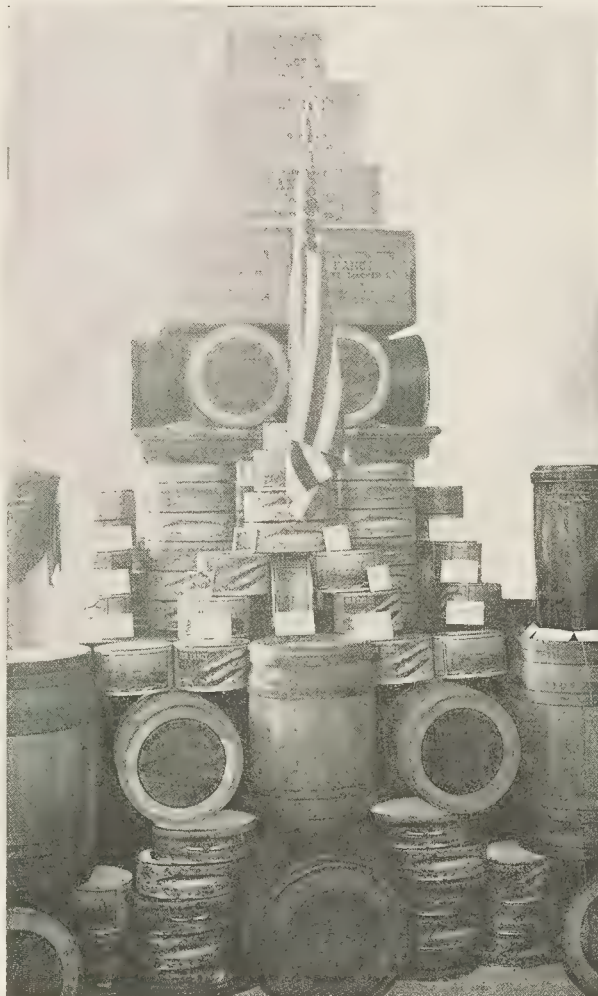
the story of which is thus related in Babson's *History of Gloucester*. "Captain Andrew Johnson," he says, "had built in 1713 a vessel which he had masted and rigged in a peculiar manner, the same as the schooners of the present day. When launched, the peculiar skipping motion she made as she glided into the water from the stocks caused one of the bystanders to exclaim, 'O how she scoons!' Robinson instantly replied, as he dashed a bottle of rum against her bows, 'a scooner let her be.' Since that time the same class of vessels have been called schooners." In 1879, about which time the Cape Ann fisheries gave forth their maximum yield, there were about 900 vessels employed, with more than 5,000 men, the catch for that year amounting to 35,000 tons.

In the Gloucester section, adjoining the rotunda of the Fisheries building, is everything that pertains to the fisheries which she controls, from the colonial era to the year in which we live. A large portion of her space is occupied by a harbor scene, representing a fleet of fishing vessels built between 1775 and 1893, among them the *Chebabaco*, launched in 1775, the *Handliner*, in 1840, the *Pinkey*, in 1810, and two English craft whose history dates from 1623, while of those of modern build there are many famous specimens.

The section is arranged in the form of an octagon, each face of which, except the one in the water, is surrounded by an arch, and over the enclosure thus formed is a canopy of nets and seines. The object of the exhibit is to show the chief industries of Gloucester in pleasing and instructive form, and to illustrate her progress as a fishing port during nearly three centuries of growth. Here is represented in miniature the primitive wharf of colonial days, with the old-time flake or platform, fashioned of sticks and supported by stanchions, on which



SEINES AND NETS



PRODUCTS OF GLOUCESTER FISHERIES

the cod were dried. Near by is the modern wharf, where the men are at work spreading the fish and packing them for market. All the most recent methods for handling fish are shown in contrast with those of the past. At the head of the wharf, or near it, are spacious fish, smoke, and salt houses; and by way of contrast as to methods of cleaning vessels is an ancient craft, carefully scrubbed and painted, near to a handsome George's bank schooner mounted on a ship-railway, the scrubbing and painting performed by modern processes.

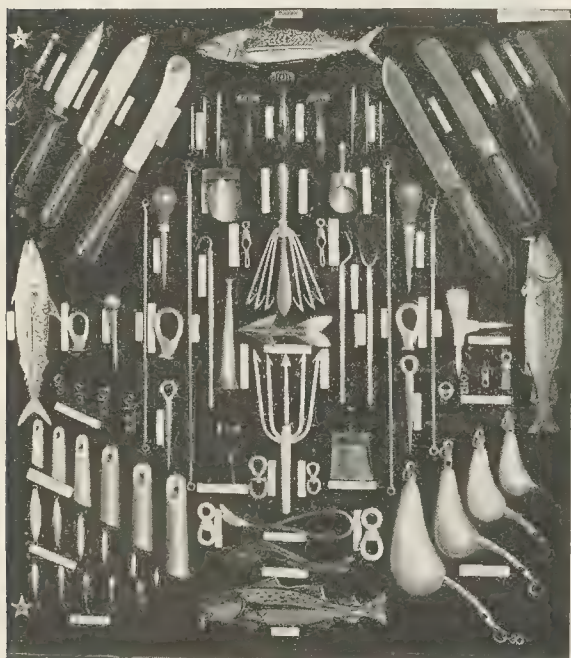
But the most striking feature is a mast-head 40 feet high, the top-mast rising from the side of the section next the dome, and on the cross-tree a fisherman scanning the waters for a shoal of mackerel. In front of the arch facing



HAND LINE, SINKERS, ETC

ocean's depths complete this interesting collection.

A Gloucester firm has an exhibit adjoining the one described, including a large assortment of the products of its establishment, as glue preparations in barrels, cans, boxes, and jars, with papers, tags, and envelopes, so arranged as to demonstrate the adhesive qualities of fish glue. Elsewhere in its section leather is glued together, and pieces of wood are fastened to iron. There is also a display of fish mucilage, of guano made from salt fish, and of bone waste and ground fish-bones for fertilizing purposes.



CABINET OF FISHING GEAR

the central fountain is the inscription "Gloucester, Mass., U. S.," and on the capitals of the pillars which support it, the figures 1623 and 1893. On these pillars are statistics as to the cost, trips, catch, casualties, and other incidents relating to the fishing fleets, showing the amount of ice used, and fish and fish products distributed. In

large photographs are depicted fishing scenes, the more pleasing phases in the lives of fishermen's families, and the buildings and environment of Gloucester.

In the background of the exhibit are pyramids of boxes, barrels, and kits; canned fish in many forms, with fish in blocks, bricks, and tablets; smoked herring, mackerel, and pickled herring. There are also numerous devices for storing fish, with lines, nets, seines, trawls, buoys, and signals. Then comes a large assortment of fishermen's clothes, with tarpaulins, rowlocks, anchors of various sizes, patent windlasses, ice-crushers, fish-hooks, fish-knives, and, in a word, everything that pertains to fishing craft. An old American flag, with 27 stars, used on a fishing vessel threescore years ago, a large assortment of shells, sea-weeds, and curiosities gathered from



A GLOUCESTER PILOT

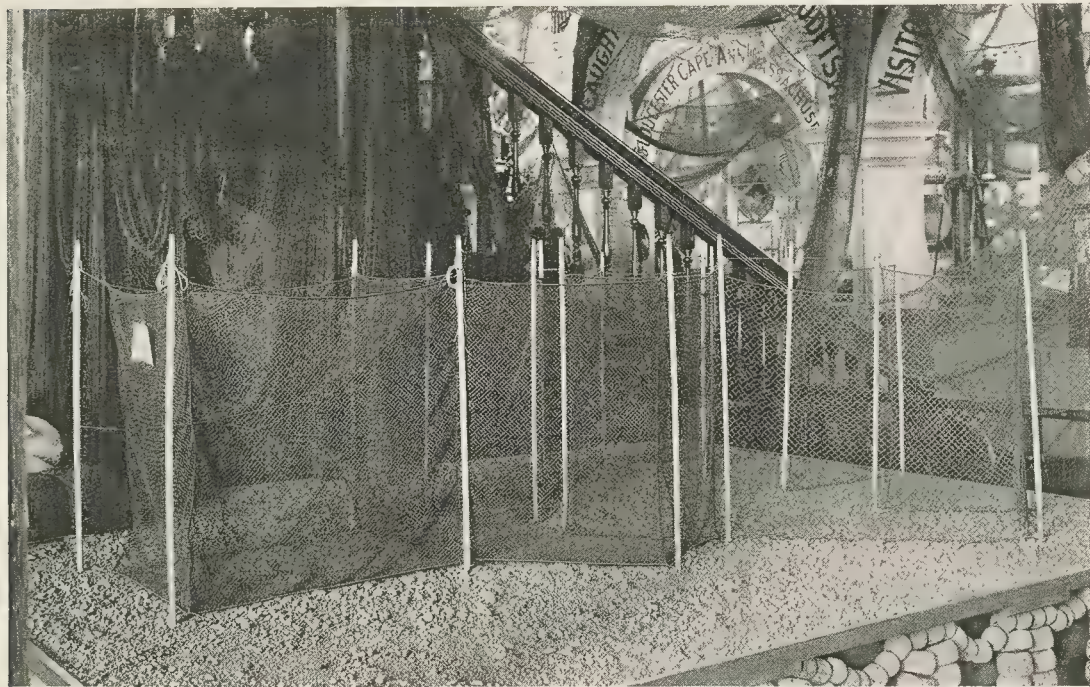
Fronting on the central nave in the southeastern section of the building is another exhibit by a Gloucester firm, consisting of fish glues and articles made therefrom. In the centre of its court is a pyramid of liquid glue in jars, bottles, and cases. In show-cases containing hats and shoes are indicated some of the uses to which this material can be put, and in one of the corners a large bell weighing over a ton is suspended in mid-air as a test of its tenacity. There are also wagon axles with the steel and iron joined by glue instead of by nails or bolts, and a large cannon is so suspended as to illustrate its adhesive qualities when applied to wood and leather. In a collection of fish skins are shown the special grades from which the glue is extracted.

In the northern gallery is an interesting collection from the whaling port of New Bedford, which, through its board of trade, sent to the World's Fair many curious specimens connected with that pursuit, from the apparatus used for capture to the process of oil refining. Here are shown among other articles, the old toggle iron,

Pierce bom-gun, lance-gun, English gun harpoon, blubber gaff, hooks, ladles, and knives, with samples of whale oil and soap. On the walls are displayed in graphic art the perils of a whaler's life, and the whaling vessels and wharves of New Bedford, the former of old-time and modern architecture, including the *Progress*, now lying off the convent of La Rabida. There are also models of whaling vessels and the signals used at sea, groups

of sperm-whale jaws, a large walrus head, an assortment of whale-bone, and specimens of Arctic animals. To demonstrate the process of rendering oil, there are placed in the centre of one of the sections a large blubber tank, oil coolers, and a try kettle, as used on the deck of a whaler. Over the front of this court hangs an immense blubber hook, grasping a pair of whale jaws, and hanging from the gallery, suspended over the main floor, is a whaling boat completely equipped.

Maine has a small exhibit adjacent to the rotunda, the principal purpose of which is to represent her marine and fresh water species. On the walls are mackerel, chub, haddock, striped-bass, sand-shark, codfish, herring,

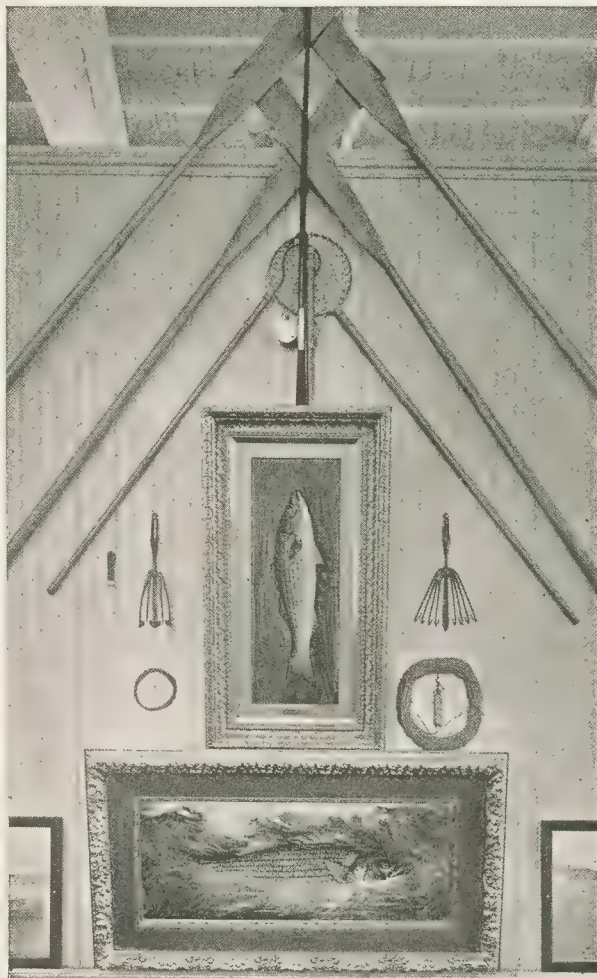


NEW ENGLAND TUNNEL POLE AND TRAP

lobster, and other varieties, including such rare specimens as the tautog and lump-sucker. In the centre of the group is a handsome painting of a salmon, and a collection of shells from the sea coast graces the front portion of the enclosure, while to the right is an aërating pump, the invention of one of the state commissioners. Adjoining this section is a display of canned goods by a Portland firm, consisting of clams, lobsters, and other shell-fish in tins and bottles grouped in pyramidal form.

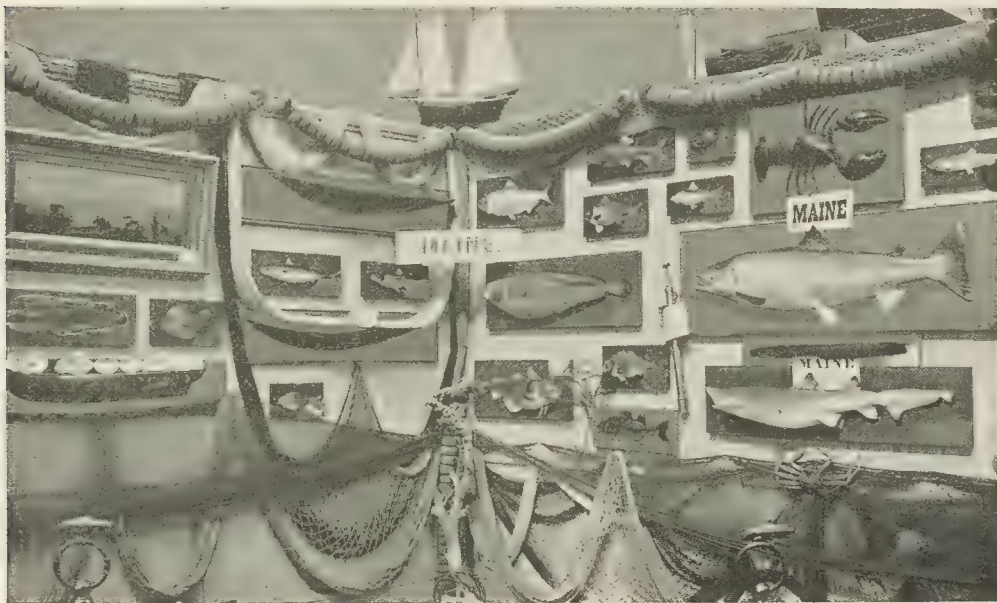
The state collection of Rhode Island occupies a liberal space in the Fisheries building, appearing to excellent advantage in the southern half of the central nave. Of the oysters taken from New England beds, valued at about \$1,500,000 a year, a large proportion comes from that state, and another source of wealth is her manhaden fisheries, a species of the herring genus. Both industries are fully illustrated, everything that relates to the quest, capture, and preparation of fish for market being here displayed in models and graphic art. Among the former is one of the fishing steamer *George W. Humphrey*, showing remarkable fidelity of detail, and nicety of workmanship. Every particle of the vessel's equipment is reproduced, even to the rope which lowers the net, while down in the hold, carefully rolled away in tiny boats, are the finely knitted seines. From the mast is displayed the name of the steamer on a miniature flag, and near by is a model of the *Seven Brothers* on a less elaborate scale. Other models are those of a strike-boat and a cat-boat rigged and equipped for service in the scallop trade. In photographic form are represented many phases of the Rhode Island fisheries. In some of them are men setting, pursing, and gathering in the seines; in others are steamers towing heavy working boats, and there are sunset scenes on the water, with lighthouses in the distance, from paintings by eminent artists. Here also are shown the dwellings of the more prosperous fishermen of Tiverton, and in large, handsome paintings are grouped the choicest specimens from stream and ocean. Fronting on the nave is a famous boat, the story of which is told in the following inscription: "Presented to Ida Lewis, the heroine of Newport, Rhode Island, for her daring and successful efforts in saving human life in Newport harbor."

In a large case is shown an improved scup-trap and a model of a purse-seine, for capturing minnows, the former a remarkable contrivance. It consists in part of a long leader, with poles and netting, the fish coming alongside and around the leader, and finally landing in an enclosure called the kitchen. Should



PORTION OF RHODE ISLAND'S EXHIBIT

they swim ahead, the netting of another compartment is encountered, to which there is access through a square hole in the centre of the wall of netting which bulges in toward the kitchen. A large portion of the fish enter through this hole, thus reaching what is termed the parlor, and are thence transferred to the boat. To

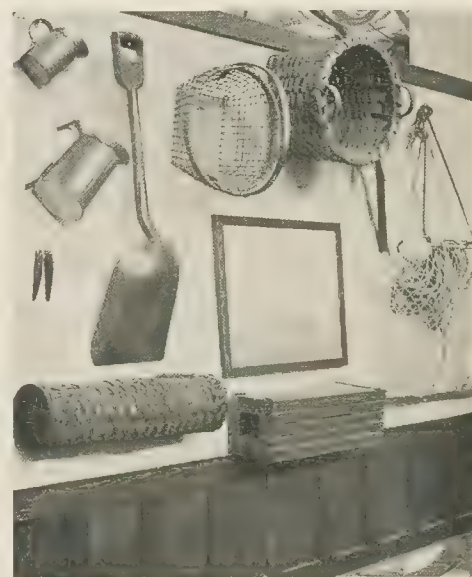


CORNER OF MAINE SECTION

interpret the meaning of this device, small models of fish in metal are arranged in shoals, some having the appearance of swimming outside the leader, and others following them into the meshes of the trap. Near by is a miniature semblance of an old-fashioned trap, such as was in use half a century ago. Of hooks, rods, reels, nets, and tackle there is a large and varied exhibit, with a complete collection of oyster dredges, old and new, baskets, pots, rakes, measures, shovels, and other apparatus, showing how these fish are caught and handled. Tools for handling clams, spears for capturing lobsters, eel lanterns, sorting-boards, and luring nets are also among the minor features of the display.

The state of New York is not represented in the Fisheries building, but the space assigned to her, east of Maine's collection is occupied by several of her metropolitan firms. The most elaborate display is that of Max Ams, in which are demonstrated the most improved methods of preparing and packing fish for market. In the centre of the court is a row-boat filled with mounted sturgeon from the Delaware river, to the right of which is a large assortment of caviare, Russian sardines, anchovies, and other fish, in cans and barrels. One side of the enclosure is banked with a variety of canned goods; another group consists of pickled lobsters, herrings, shrimps, American caviare, sturgeon oil, isinglass, and sturgeon fertilizers. In rear of this section is a pyramid of potted and bottled fish goods ready for exportation, and on one of the partition walls are depicted the fishing grounds of Bayside, New Jersey.

Adjoining this section are the exhibits of other New York firms, whose individual collections include sardines and Columbia river salmon in cans, and glues from the skins of cod and cusk, with apparatus for testing glues and a device for determining the adhesive quality of fish cement, the latter a recent invention. Other firms have a joint display of caviare, Russian sardine jam, Berliner roll herring, spiced sea-trout, and a large variety of other salt-water fish in cans, kegs, and jars ready for market. There is also



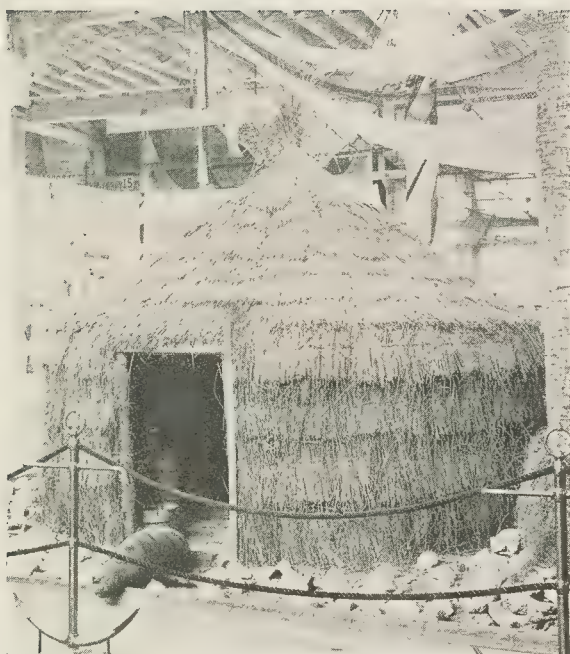
RHODE ISLAND APPARATUS

a special exhibit of barrelled, boxed, and canned mackerel, and around the enclosure are views of sardine canning factories, showing process of cleaning, salting, packing, and the manufacture of cans and other articles.

To North Carolina a large and prominent section was awarded in the northern division of the Fisheries building; and here is a display well worthy of a state which in this as in other industries ranks among the foremost of the southern sisterhood. In her river and sea fisheries several thousand men are employed, and several hundred vessels, the yield of the former averaging from 12,000 to 15,000 tons a year, and of the latter, including oysters, more than half as much. Since the depletion of the Chesapeake oyster grounds, the North Carolina beds have gone far to supply the deficiency; the public interests are here carefully guarded, a commissioner, appointed for the purpose, frequently visiting the beds and capturing or driving away intruders, while armed patrolmen are constantly on the alert. In flavor, size, and shape, the oysters differ widely, a favorite species coming from the New river grounds, though others are largely in demand, and as is claimed are not inferior in quality.



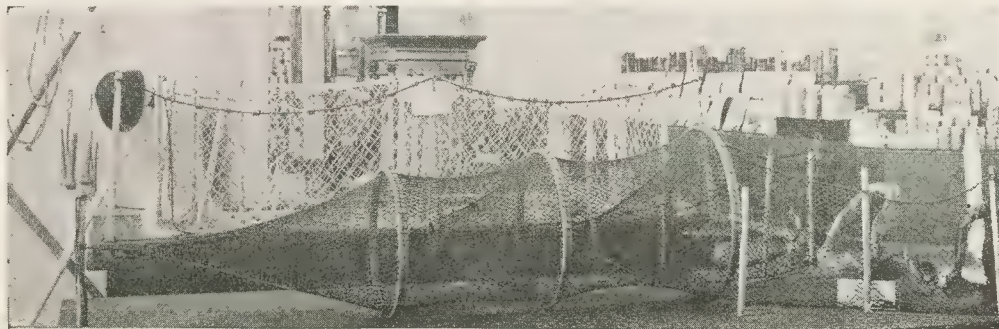
FROM FOREIGN SHORES



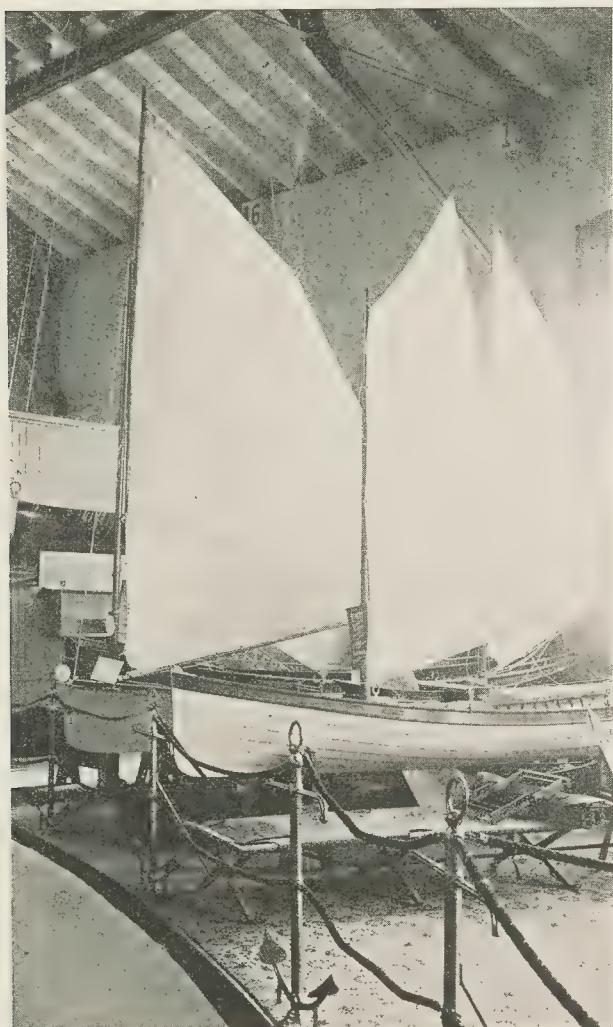
RUSH CAMP OF NORTH CAROLINA

fertilizing properties, while views of the guano factories show the process of its manufacture.

Among samples of food fish are the Spanish mackerel, pompano, black-bass, and mullet, with caviare prepared from the roe of the sturgeon for foreign export, and the fish of which isinglass is made. At the northern entrance are the jaws of the shark, and near the main portal is the head of a large spear-fish from the state museum, near which are harpoons for the capture of whales. Elsewhere are clam rakes and tongs, boat anchors and hooks, sound pulleys, and nets of many descriptions, with an Albemarle seine



FYKE NET. NORTH CAROLINA SECTION



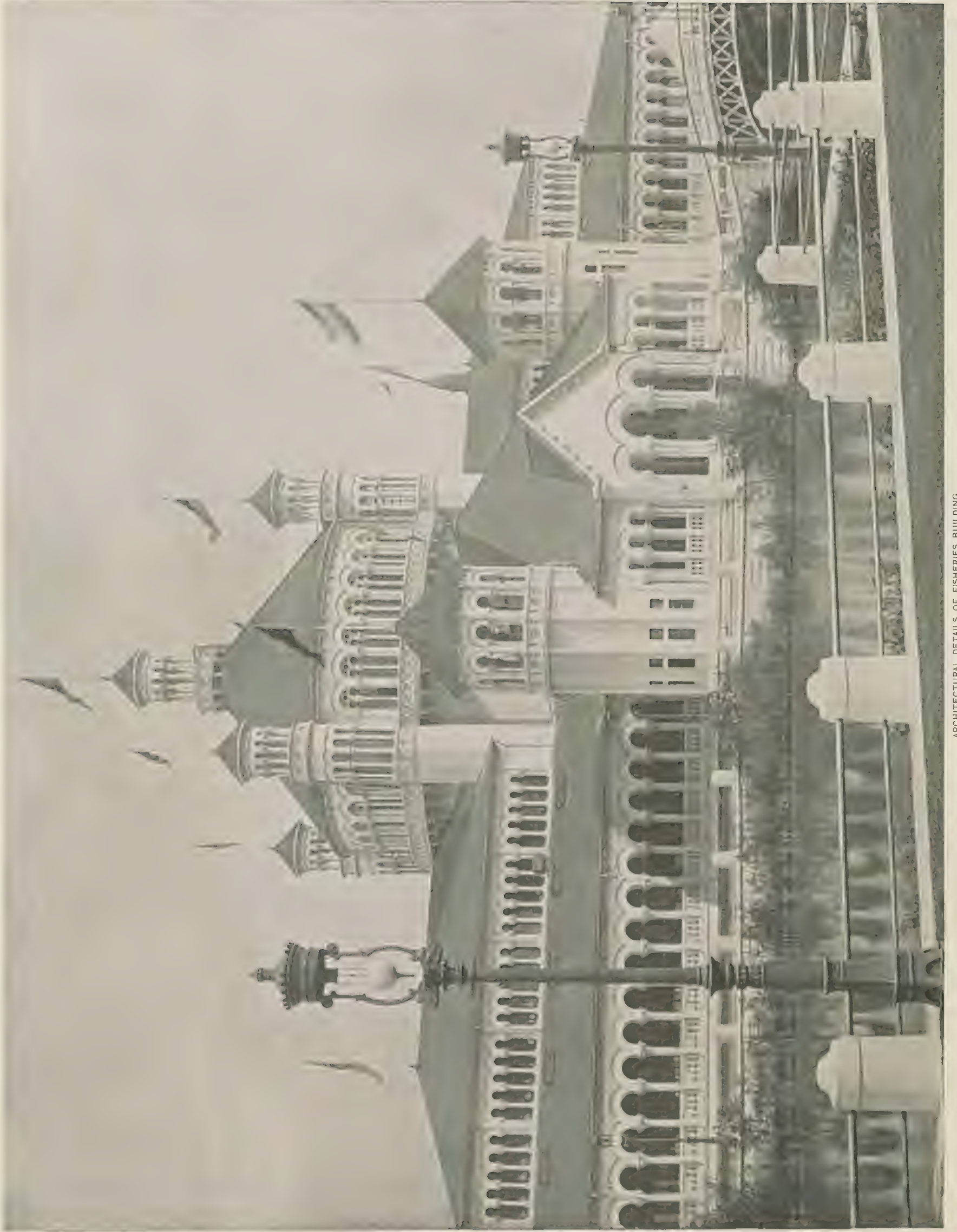
ILLINOIS SAIL BOATS

2,500 yards in length, here reproduced in miniature. On charts are outlined the principal fishing and oyster grounds, with statistics as to the various branches of North Carolinian fisheries.

Among the special exhibits in the Fisheries department may be mentioned a Louisiana alligator, twelve feet long, and the largest of two sent alive to the Fair as a contribution from that state. The change of temperature proved fatal to both, and the one on view was stuffed and mounted for exhibition on account of its enormous size.

Illinois is mainly represented by a Chicago packing firm, whose space, adjoining the northern portal, is indicated by a series of pillars, supported by oars, above which is a drapery of flags and net-work. Life-buoys extend along the entire front, and over the entrance is the head of a deer, decorated with bunting. Within is a large pyramid of canned oysters, with pillars of canned goods at the corners rising to the ceiling, and a base of oyster shells. Elsewhere are shrimps, salmon, and oysters in cans, shells from the Azores, finger-sponges, star-fish, sea corn, and egg cases of the sea-whelk or winkle. To illustrate the effect on wood of the tored, or boring worm, an old tackle block is shown perforated with holes.

In this collection is a lobster weighing more than twenty-three pounds, the largest thus far recorded. A model of a dory shows the type of vessel used for lobster capture along the New England coast, other models representing a crate for holding lobsters while boiling, a modern lobster trap, and a floating car for keeping the fish alive while on their way to market. The different modes of shipping bulk oysters are demonstrated in a collection of cans, barrels, and pails of recent pattern, and there are photographs and paintings of scenes among the canneries, with fishing boats and a



ARCHITECTURAL DETAILS OF FISHERIES BUILDING

large wharf at Astoria, Oregon. By way of decoration are the heads of buffalo, elk, and reindeer on the further side of the court; in one of the corners is a small white baby seal. In the northern aisle of the gallery is another group of canned goods, including anchovies, lobsters, herring, and salmon.



PART OF OREGON'S EXHIBIT

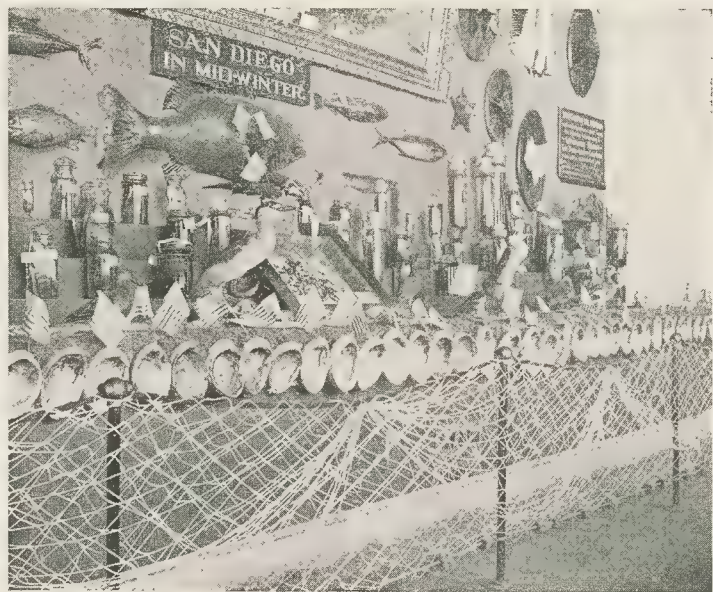
fishermen in early days, and phases of Indian life and habits. The state hatchery at Willowbrook, and the hatchery of the United States fish commission at Duluth, are given due prominence, as also are the commissioners. In the piscicultural department are drawings illustrating the various stages in the development of pike and perch. Above the collection of birds and fish is a large canoe, in which are seated two life-sized Indians, one guiding the boat and the other in the act of spearing a fish.

Fronting on the central transverse nave is California's small but choice display, consisting mainly of colored casts of her various food fishes. Among them are specimens of the king-salmon, orange rock-fish, white sea-bass, Sacramento pike, starry flounder, grass rock-fish, the scombridea, with such rare and peculiar species as the cabrilla, speckled

scorpine, Spanish flag, and others; and as representing the entire coast, the jew-fish, pesca, vermiglia, striped bass, and a large mounted sturgeon. The

members of these groups differ widely in size, shape, and color, giving to the entire collection a unique and novel appearance.

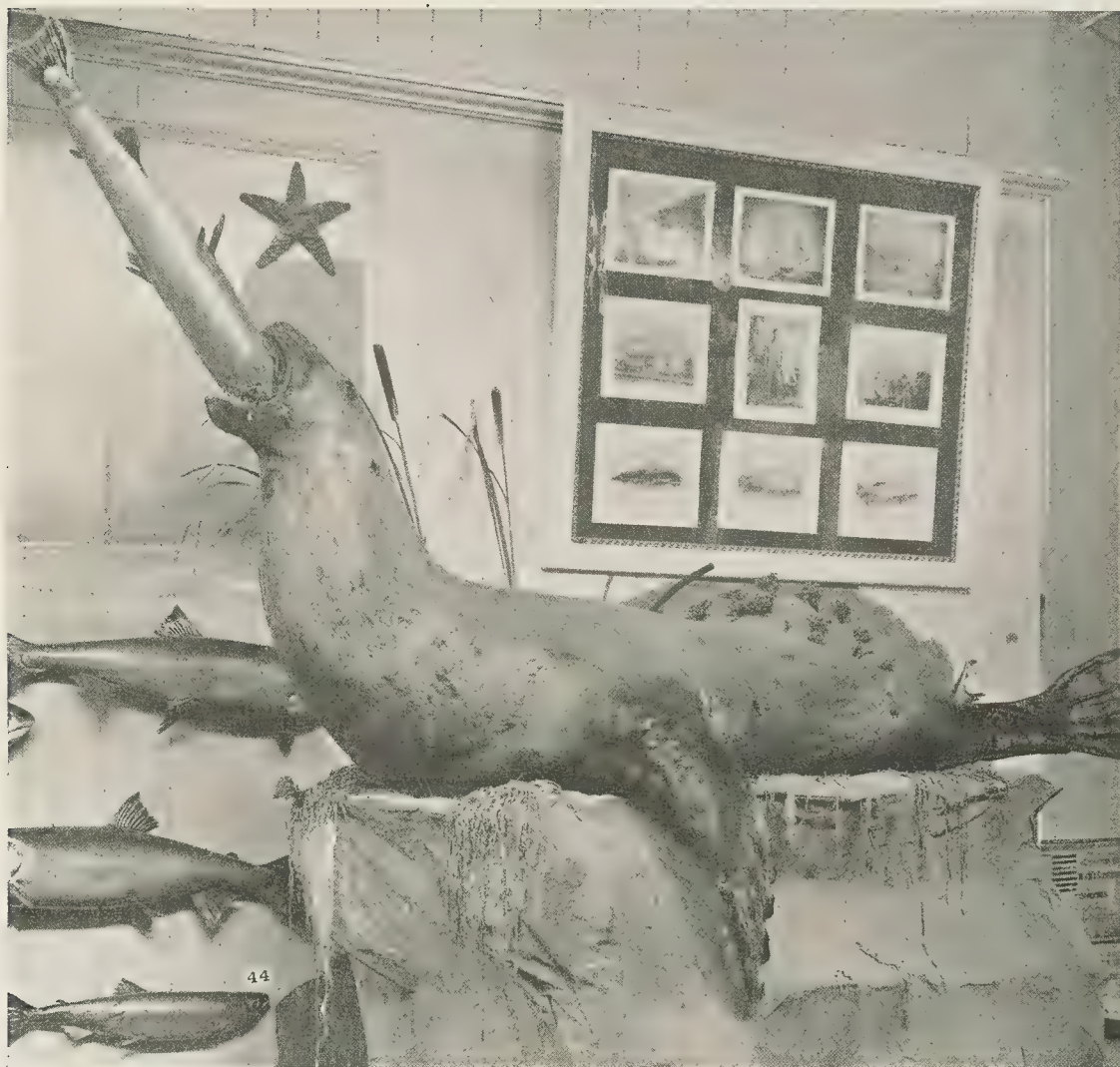
At the eastern end of the main building is the exhibit of the high school of San Diego county, California, in whose show-cases is a carefully selected assortment of star-fish, corals, sea-moss, pearl and other shells, with many beautiful articles made therefrom. Near these are groups of crabs, horned toads, abalones, shark's jaws, shark's eggs, and the ear-drum of a whale. In another division, extending the entire length of the space, is a great variety of fish-eating birds, as the curlew, butter-ball, American white pelican, and road runner. There is also a large collection of San Diego fish, both mounted and dried, including the salmon, white-fish, rock-cod, croaker, black-perch, and blue-fish. The leopard shark and devil fish are here on exposition, and there are many fancy articles skillfully fashioned of scales, shells, and seaweed, with other rare articles scattered so liberally throughout the exhibit as almost to give to it the appearance of ocean's bed. A large picture of San Diego and the surrounding country, showing Coronado beach, National city, the table lands of Mexico, and the snow-capped mountains of Cuyamaca,



FROM SAN DIEGO, CALIFORNIA



JAWS OF WHALE, SECTION ENTRANCE

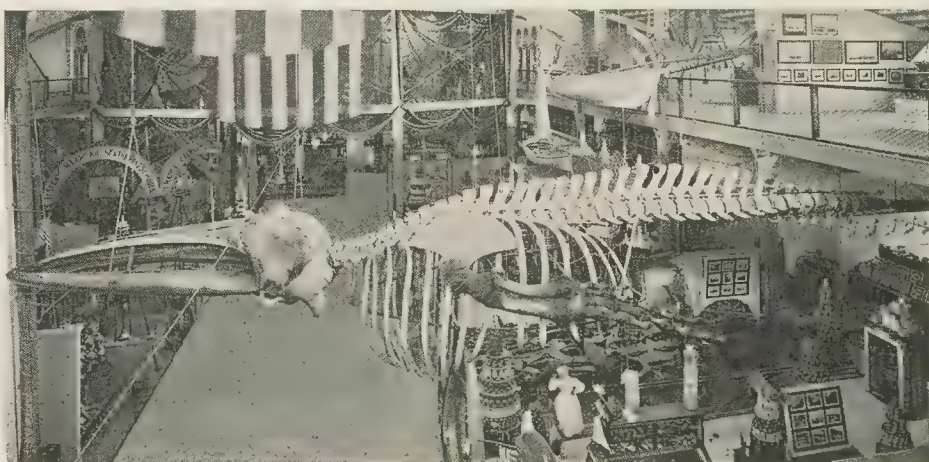


A FEAST OF SALMON, WASHINGTON EXHIBIT

suspended the skeleton of a whale, its jaws forming an archway at the entrance of the court. The exhibit consists largely of canned goods, including salmon, sturgeon, crabs, and lobsters. Of fish destroying birds, the eagle, whistling swan, and North American bittern are the largest and most voracious specimens. In well preserved specimens are also the wolf-fish, salmon, dolly-var-den fish, trout, squid, and other river and ocean species. Oysters, native and acclimatized, mussels, clams, of the short-neck, razor-back, and mammoth varieties are well represented. There are likewise shrimps, cockles, and a large collection of mounted fish, as white sturgeon, star-fish, chinook, blue-perch, flounder, rock-cod, white-perch, sculpin, and salmon in every form.

In the centre of the court are models of fishing-boats, including one with its outfit occupied by the Makah and other Indians who captured the Exposition whale, together with the relics and fishing implements of various Indian tribes. A mixed collection includes shells, barnacles, sea-weeds, and other ocean products, with harpoons and various implements made of bones and skins, while poised erect at the rear of the enclosure, with a fish in its mouth, is a large sea-lion from the Columbia river, whose scenery and fishing industries are reproduced in photographic form.

Salmon taken from the Columbia river form the mainstay of the Oregon and Washington fisheries, and were introduced into foreign markets long before canneries were established by American citizens. From about 21,000 cases in 1869, the pack increased to 629,000 cases in 1883, when the maximum yield was reached, the catch thenceforth diminishing with the rapid depletion of the fisheries. Meanwhile the export trade, beginning with 30,000 cases in 1871, rose to 479,000 cases in 1876, realizing more than \$2,500,000. Of Alaska, though not represented at the Fair, it may here be stated that her canneries bid fair to rival those of the Columbia, their output showing a steady gain, and gradually finding favor among eastern and European communities.



SKELETON OF A WHALE

serves as a background covering the surface of the partition wall.

Oregon's display consists mainly of canned salmon, in the form of pyramids, the joint exhibit of the leading packing houses of Astoria. A model of a salmon boat, fully equipped, and a patent scoop, or salmon wheel, show the method of capturing salmon on the Columbia river. Finely preserved specimens of salmon are here, as also are clams, red trout, porgies, and blue-back bass. A case of pheasants and a picture of Mount Hood in the background form pleasing additions to the display. There is also a picture showing an Astoria fishing fleet returning from the grounds with a heavy catch, near to which is a fur-seal, weighing over 1,200 pounds. To Oregon was assigned an additional section in the east gallery, where was placed an assortment of canned salmon and fish packed in various forms.

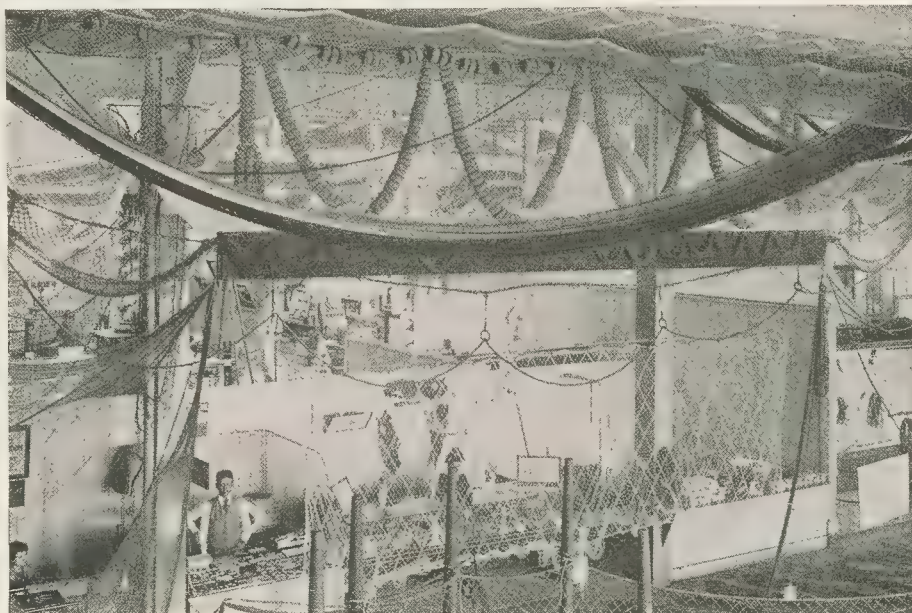
Above Washington's enclosure, adjacent to Oregon, was

Among foreign exhibitors Norway occupies a large and prominent section on the northwestern floor of the

Fisheries building, where is well represented an industry in which one-fifth of the population is directly employed or interested, one that forms a large portion of the food supply, and with a considerable surplus for export. Here sea-fishing is conducted almost entirely off the coast, and in open boats, owned for the most part by the fishermen themselves. At the Lofoden grounds, in the far northwest, the largest of Norwegian fisheries, 30,000 men assemble, with 7,000 or 8,000 boats, and of their cabins, built among a group of islands within the Arctic circle, a specimen in Norway's court serves as the office of this department. Though here, as elsewhere, storms prevail for about one-half of the season, the catch in fine weather is phenomenal, the take of cod being estimated at 56,000,000 a year. Herring and mackerel, of which there are several species, are next in economic value, and among others the salmon, whale, and seal fisheries swell the total exportation of fish and fish products to \$12,000,000 a year.

In front of the Norwegian court is a series of pillars, adorned with flags, and between them a drapery of netting, with net-buoys and other objects of interest. At the entrance is an arch formed of boat-oars tastefully decorated, with the word

"Norway" conspicuously displayed, and above it the crown of Norway resting upon the royal coat of arms.



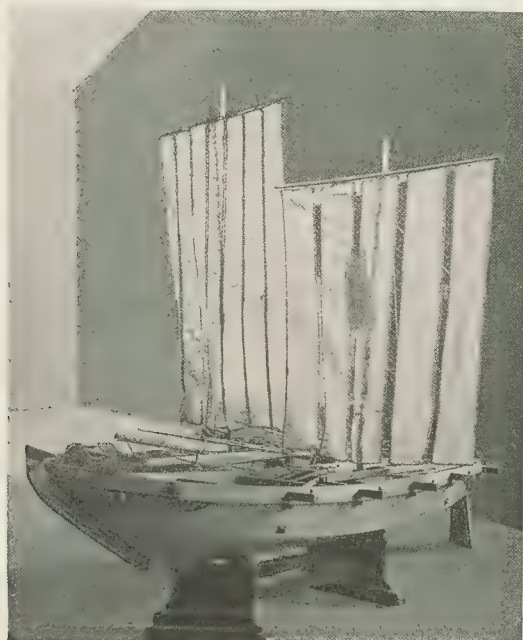
WITHIN THE FISHERIES BUILDING

The court is in two sections, divided by the northern aisle, each section being in several compartments. To the left of the entrance is the fisherman's cabin referred to, a red colored structure, with small windows and a cosy fireplace. The exhibits cover the entire fisheries of Norway, and especially to deep-water fishermen, are of surpassing interest. Everything relating thereto is arranged in artistic forms, both as to fish, appliances used for their capture, and all the various uses to which the product is applied. In the foreground is an historical collection of models of fishing craft, beginning with the staunch, unwieldy boats used by Norsemen many



FISH OF THE FAR NORTHWEST

centuries before the Columbian era. All are of full size, completely equipped, and show every known device for catching fish. Among the models of modern craft are whaling, cod, and herring boats, manned and with every kind of apparatus used in localities ranging from the whale and seal fisheries of the north to the mackerel grounds of the southern peninsula. There is also a model of a whaling steamer, on the upper deck of which is a miniature cannon, with bomb-harpoon and a complete equipment for catching the bottle-nose whale. Here also is a model of an improved foghorn, differing from all others in that the air is pumped into one side of a square box, from which on becoming surcharged it escapes through a horn on the other side, with a sound that can be heard for a distance of several miles.



ORIENTAL FISHING BOAT

Along the wall of this section are plaster casts of Norwegian fishes, including the hake, ling, flounder, lemon-sole, herring, shad, plaice, turbot, whiting, mackerel, polar red-fish, lump-sucker, eel, gray gurnard, and many other varieties. In boxes, cans, and kegs is an assortment of fish in marketable forms, and on the centre of the wall is a large oil painting, the theme of which is a gale off the northwest coast of Norway.

In another section, separated by a long row of pillars reaching from ground floor to gallery ceiling, is a valuable collection of specimen products of Norway fisheries, displaying in separate jars, first the fish, then the oil, scrap, and bones the two last also in the form of fertilizers,

Meal made of fish is among the collection, and around the pillars are piles of bloaters, mackerel, herring, anchovies, cod, and so forth. In tiers, one above another, rising to the roof, are samples of dried and pickled fish, and dried back-bones of cod; and in other groups are barrelled and canned fish, and the salted roe of the cod and mackerel. In addition to the products of the whale and seal, are isinglass, oils for medicinal purposes, boiled cod, preserved fish, meat, and game, and potted omelets and roes. A fine display of cod liver oil comes from Lofoden and other fishing centres. The Modums fishing association displays its piscicultural apparatus, and a large collection of skin and oil clothing shows how fishermen dress in various localities along the coast. An instructive exhibit is from the Exposition committee at Bergen, with various well developed



VIEW IN NORWEGIAN SECTION

specimens contained in bottles, by the side of which are the results of a careful analysis, showing among other items the percentage of potash, water, and lime contained therein. The same association shows the salted skin of a Greenland whale, a tanned wolf's skin, seal skins dressed with alum, and a reindeer's skin with head and horns attached.

North of the aisle which divides the court the remainder of the exhibits are arranged in convenient groups along the walls, the canned goods including stock-fish, split fish, preserved shredded fish, and preparations of jellies and sauces, with monster cases from every noted fish mart in Norway. In other sub-divisions, enclosed by screens and railings, are the exhibits of the Bergen committee, which has still another collection of fish products, in more than fifty varieties, with improved fishing implements, anglers' outfits, nets for catching every kind of fish on the coast, buoys and beacons, gaffs, sinkers, seines, weirs, lobster and eel traps. There is also a patent winch, a contrivance for hauling in cod and herring nets, and one that can be used for hoisting sails and masts. In another case is a large variety of lines, and near by a whale harpoon, with cannon and shells. A third group consists of artificial bait; and there is an interesting collection of hooks, dating from the year 1797.

The exhibit of aquatic birds by the Bergen committee includes the eider duck, of which there are many specimens, the yellow-legged gull, the diver, cormorant, guillemot, and ouzel, while the effect is greatly enhanced by beautiful quilts made of eider down. A large polar bear, in the act of catching a seal, forms the central figure of the section. Photographs and sketches, giving a panoramic view of the coast, show the various fisheries and harbors, and Norwegian game fish are freely illustrated. On statistical charts are represented in colored circles the amount and value of the catch at each station from 1866 to 1890, with other data relating



SAIL BOATS

Models of fish curing and canning establishments, show the processes of drying, salting, smoking, trimming, and cooking, while appliances for preserving fish during transportation are also reproduced in models. By the fishery association of Modums is exhibited a model of a fish-hatching apparatus, with vessels for catching the roe and fry in different stages of development, and breeding and rearing establishments for oysters and other shell-fish. Around the walls are pen and ink drawings of fishing scenes in northern waters, and a large painting of Arctic scenery, with icebergs, and a party of hunters on ice-floes in the act of spearing seals.

to the fisheries. Here also a private firm has samples of cod-livers in various stages of growth, and near it are various grades of cod-liver oil, with models of refining apparatus and a cod-fishing boat, and photographs illustrating these fisheries.

By the Bergen committee is also displayed a collection of shells, sea-weeds, sponges, corals, and marine curiosities.



MODELS OF BOATS



NORWEGIAN FISHING CRAFT

In the gallery, the first two sections on the north side are occupied by an exhibit of Norwegian seines, nets, lines, and a large assortment of dried fish. The sections along the west end contain numerous implements for fishing, and appliances for handling and transporting fish to market, with floats, buoys, sinkers, and other apparatus. The entire enclosure is draped with netting, copiously decorated with flags and emblems, and across the entrance is the national coat of arms.

Great Britain has a small but choice display adjoining the western entrance of the Fisheries building. To the right of the enclosure is a Scotch exhibit of salmon flies in a handsome gilt case, and another Scotchman illustrates in diagram form the method of electric communication with fishing fleets at sea. The latter shows first the electric signal



ANCHOVIES FROM NORWAY

cabin ashore, and then the submarine cable, extending from shore to within a convenient distance of the fishing grounds, where it is moored to a terminal buoy. There are also beacon buoys, carrying metal flags to indicate the course, and at both ends are electric bells. A novel feature is that the cable can be picked up by means of a grappling hook, and messages sent ashore from any point. Near by are plans and diagrams of ice houses, models

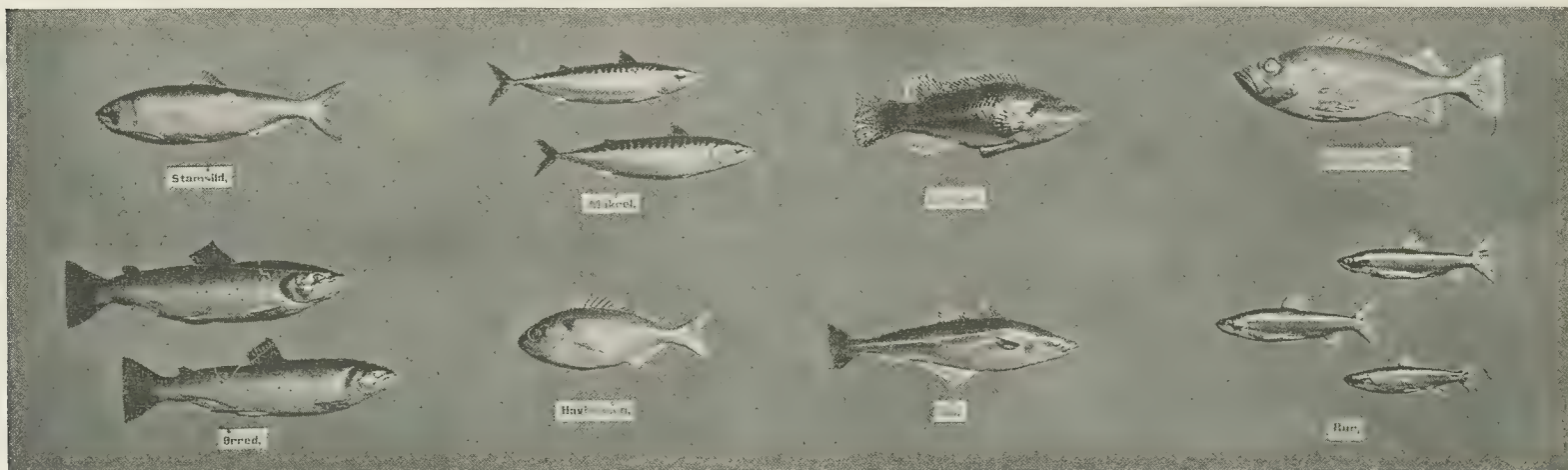
of railway cars for conveying fish to market, and of the boxes in which they are packed. Another series of diagrams show a fisherman's portable bothy, adapted to the herring grounds on the coast of Scotland. The structure is built of undressed wood, and rests on a mound of rock; its roof is of corrugated iron, and its floor of earth, ventilation being from above. Other designs by the same exhibitor are in the form of permanent dwellings for fishermen.

From a prominent fish-curing establishment of Scotland is an exhibit of finnan haddies, sun-dried cod, saith and ling, cured fish and barrelled herrings, the last also displayed by a Glasgow firm. A London house has a large collection of India rubber goods, as waders, fishing trousers, boots, overalls, and various articles pertaining

to the outfit of sporting fishermen. London has also an elaborate assortment of hooks, from those which catch the whale to such as are used for the capture of minnows; together with an assortment of flies, needles, prongs, and lines. Decoys, as worms, toads, reptiles, and butterflies are arranged in various forms, and a



COD LIVER OIL



DENIZENS OF NORWAY'S FISHING GROUNDS

number of gold medals shows the exhibitor's standing at previous expositions. Still another English firm has a collection of hooks for both sea and river use, and adapted to the fisheries of every land.

Occupying nearly one-third of the British space is a model of the Baltimore fishery school, in the county of Cork, Ireland, the special contribution of Baroness Burdett-Coutts, who was one of the founders of the

school, and formally opened it in 1887. Here is shown how the pupils are taught all the arts relating to fishing and fish curing, with their dormitories, class-rooms, and net-making and mounting rooms. The special object is to explain what is being done to revive the fishing industry in a district where it had become almost extinct. The model is twenty feet square, and stands for Ireland's part in the fisheries exhibit of Great Britain.

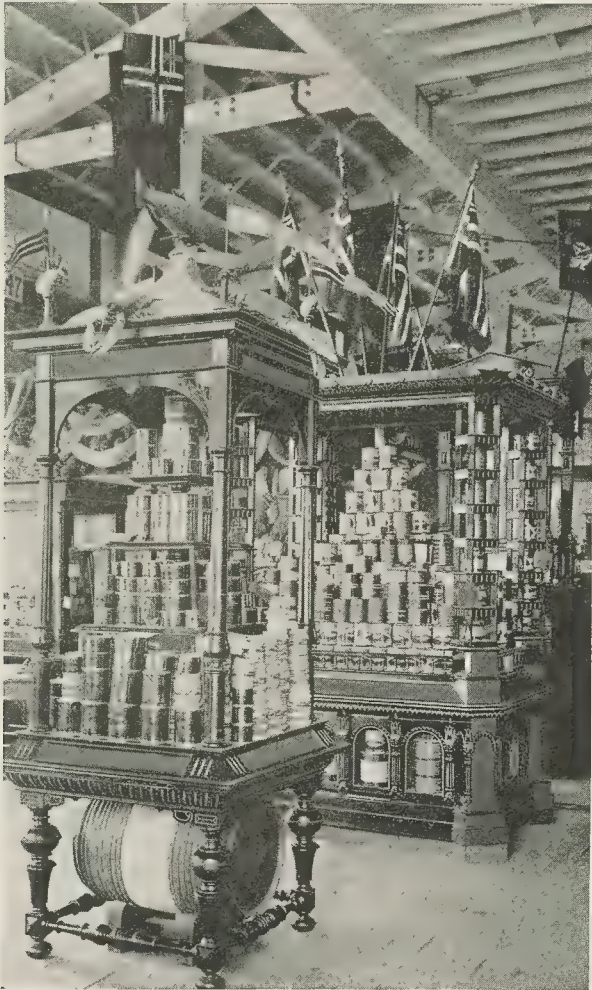
While not wanting in attractive features, the British display affords no adequate representation of an industry in which England far outstrips all other countries in the world. From the fishing ports of the United Kingdom more than 400,000 tons of fish a year are conveyed inland by rail, and including shell-fish the value of the annual catch is not far short of \$40,000,000. Yet even this enormous yield does not suffice for home consumption, imports of fish amounting to nearly \$15,000,000 a year, against \$8,000,000 or \$10,000,000 of exports. The number of men employed is almost as large as the standing army of Great Britain, probably exceeding 125,000, with 30,000 registered boats, the Scotch contributing the larger proportion; for the fisheries of Scotland produce almost as abundantly as those of England, though with a smaller relative value.

No less remarkable is the yield of Canadian fisheries, estimated for 1892 at \$20,000,000, or one-half of the British production, though the population of the kingdom is more than seven-fold that of the dominion. Cod ranks first in commercial value, with a take for that season worth \$4,000,000, and next are salmon, worth \$2,500,000; herring and lobsters, each \$2,000,000, and mackerel, \$1,500,000. In these and other fisheries are employed about 65,000 men, with more than 30,000 boats and 1,200 larger craft, while of nets and seines there are several million fathoms.

The fisheries of Canada are among the

richest and most extensive in the world, reaching, on the Atlantic coast, from the strait of Belle Isle to the bay of Fundy, and together with British Columbian shores affording 12,000 miles of ocean seaboard. Add to this the inland waters of the great lakes, of Manitoba and the Northwest territories, with rivers and streams abounding in fish in many portions of the dominion, and we have a source of wealth, as yet but partially developed, second only to her agricultural resources. Herring, mackerel, and smelt are captured in immense quantities along the seaboard of the maritime provinces; British Columbia yields, in addition to other varieties, 2,500,000 a year of salmon, and the inland waters of the dominion team with white-fish, trout, sturgeon, bass, and pickerel, the take of the first alone exceeding 23,000,000 pounds. Oysters are found in abundance in Nova Scotia, New Brunswick, and Prince Edward island, and the lobster canning industry, beginning in 1869 with a production worth \$15,000, had increased by 1881 to its maximum value of \$3,000,000, with more than 600 canneries still in operation. Protected by laws that are rigidly enforced with the aid of armed cruisers and a large force of officials, the Canadian fisheries are in no danger of depletion, while in the several provinces thirteen hatcheries increase the natural reproduction, 140,000,000 fry, mainly of salmon, salmon-trout, white-fish, and lobsters being planted in the single year of 1892.

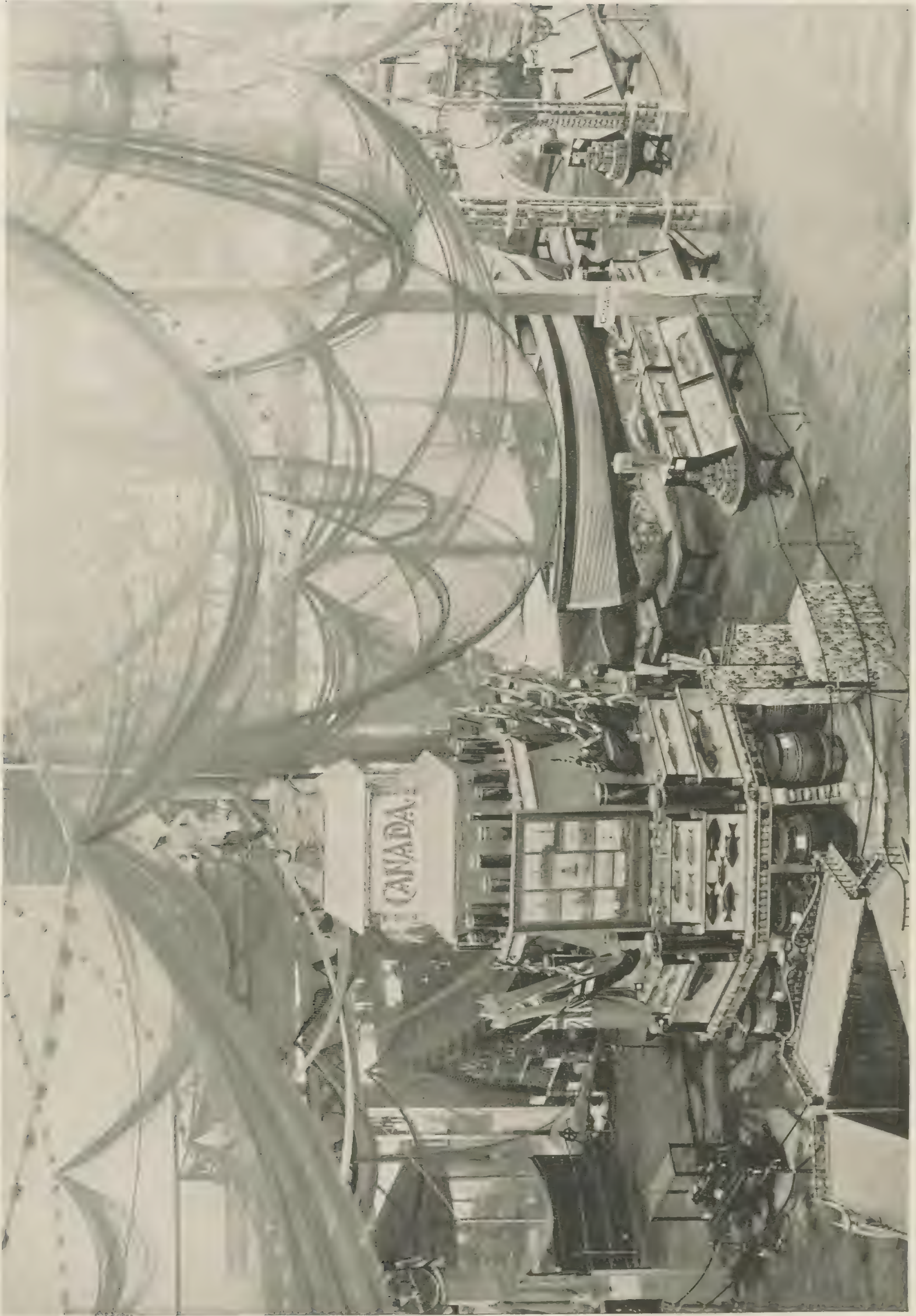
A large trophy in the southwestern section of the Fisheries building marks the starting point of Canada's exhibit, where around a lofty octagonal pagoda are arranged in tiers the various products of ocean, river, and lake. Seines of all sizes and of finished workmanship are abundantly displayed, and above all is the figure of a tall Canadian fisherman. The groups are classed in five divisions, one for each of the provinces, occupying a total space of 7,000 square feet, and forming as a collective exhibit one of the strongest features in the department.



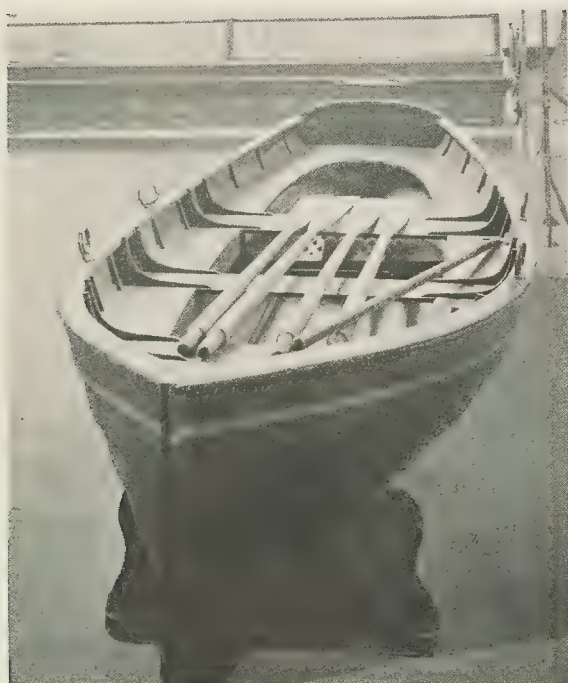
CANNED GOODS FROM SCANDINAVIA



PRODUCTS OF NORTHERN FISHERIES



PORTION OF THE GREAT CANADIAN SECTION



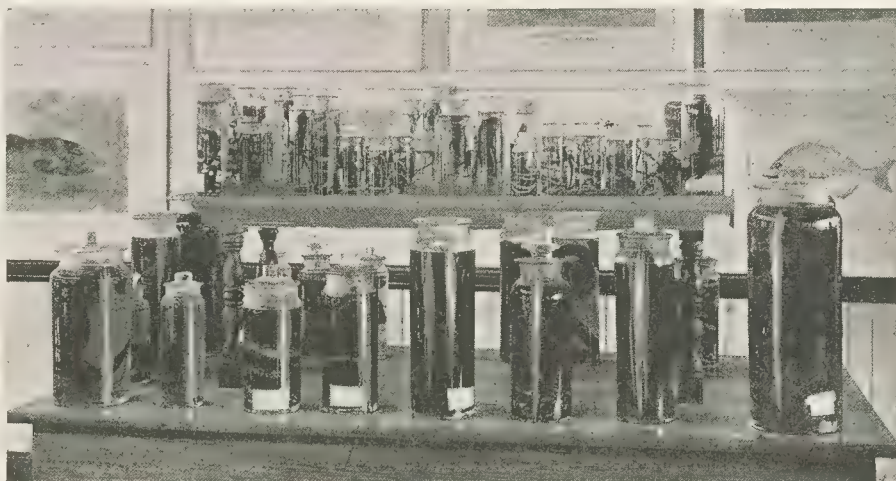
BOAT PRESENTED TO IDA LEWIS



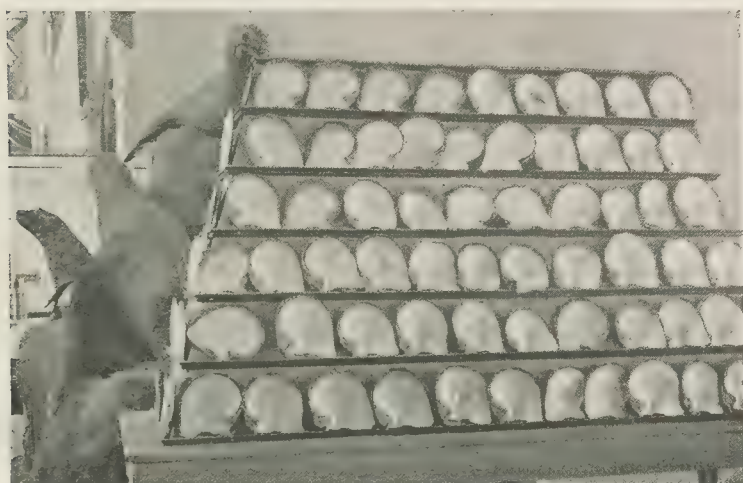
HOODED SEALS, GULF OF ST LAWRENCE

and fishing gear of all descriptions. In the front section is one of the birch bark canoes of the Micmac Indians, of New Brunswick, and near by are the canoe and dug-out of the British Columbian Indian, in contrast with which is a fishing boat from Nova Scotia, with models of other sail and steam boats. The Hockins fish-way and a lighthouse, with nine large reflectors, recently constructed near Montreal, are also shown in models. The former is unlike anything of the kind on exposition, and is best described in the words of the official in charge of Canada's exhibit. "It resembles," he says, "a hole in the bottom of a dam, with the velocity of the discharge so reduced that a fish may go against the current and swim into the pond above. It consists of a series of apartments having approximately a level floor, with side walls and transverse partitions every four feet of its length, from the bottom of the dam to above the water line. These apartments are connected with one another and with the pond above and the river below the dam. The water in the several apartments will be lower step by step from inflow to outlet, and flows out of the last aperture under the head of about two feet. Fish can easily make their way from the first apartment to those above, and it is so built up from the bottom of the pond that the ice cannot form under it." In photographs are illustrated fishing episodes along the Fraser river, Indian modes of fishing, and the scenic wonders of Vancouver island.

In an adjacent court are cans of Fraser river salmon, with photographs of New Brunswick scenery, and of fish hatcheries at Quebec and Halifax, a separate group showing the famous Ontario hatchery, with its museum and underground chamber. Fishing craft of many types are reproduced in models, as also are the vessels used for protective purposes, and a steamer forging its way through the ice of subarctic seas. There are specimens of the larger fish for which Canada is famous, among them a halibut weighing 300 pounds, a Greenland shark, and monsters of the deep from the gulf of St Lawrence, including the rare white whale, a ton or more in weight. In one of the cases are the sharp-nosed sturgeon, wolf-fish, and a pair of baby seals; and among the finest specimens of mounted fish are the quinat salmon from British Columbia and the Atlantic salmon from Nova Scotian waters, near which are otter, mink, and an Ontario beaver. In mounted samples the dominion is especially strong, including the yellow perch, salmon-trout, and many varieties of lake suckers from Ontario; sturgeon, salmon, and bass from Quebec; shad and sun-fish from New



REPTILES PRESERVED IN ALCOHOL, NEW SOUTH WALES



PART OF NEW SOUTH WALES DISPLAY

Brunswick; cod from Nova Scotia; buffalo-fish from Winnipeg, and ling, rock trout, green cod, and others from British Columbia. Inland waters are also represented, as by the cod of the St Lawrence, the sheepshead of the Detroit, the cat-fish of the Red river, and the salmon, trout, and white-fish of the great lakes.

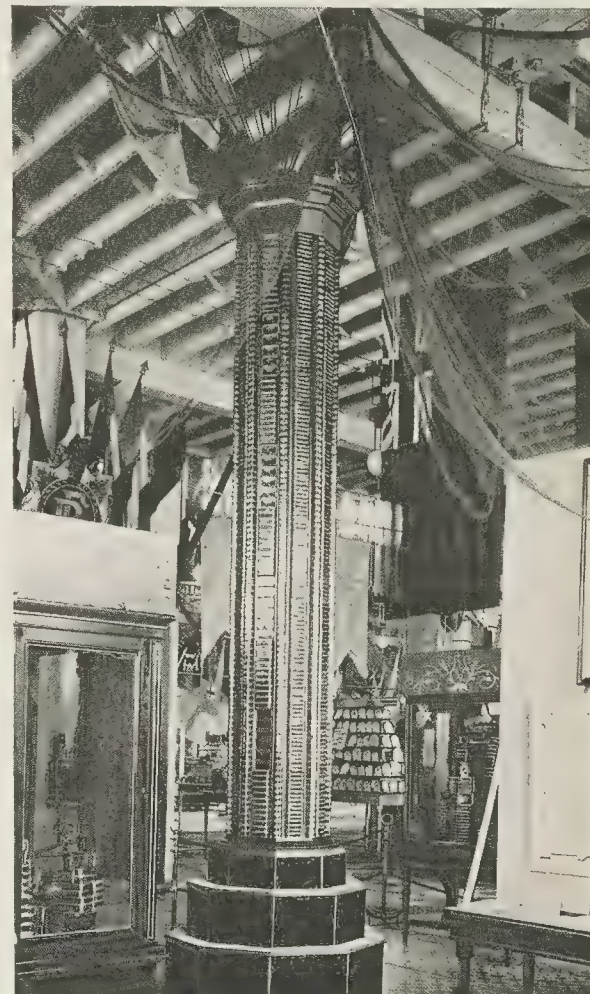
In other cases is a choice collection of preserved specimens from every quarter of the dominion. Nets, lines, and traps are freely displayed; there are assortments of whalebone, of sturgeons' sounds, and of lobsters from British Columbia, whose sealing fleets are shown in photographs, and among curiosities are an old sealing musket and the tusk of a narwahl from the Hudson Bay region. An attractive feature is the collection of shells, contributed from all the provinces. From the marquis of Lorne comes an assortment of barnacles gathered from the neighborhood of Victoria, and a Montreal exhibitor has a display of river crustacea. Among the specimens preserved in alcohol are squid, starry rae, horse-mussels, sculpin, and lobsters more than two feet long; while of fish in commercial forms there are herring, cod, and salmon in cans and barrels.

Fishing craft and their models are also among the attractions of the Canadian courts. In the front section there are, in addition to those already mentioned, models of the government vessels which protect the cod banks of Newfoundland, and of such as are engaged in those fisheries. By a Nova Scotian firm is shown the counterpart of a Newfoundland fishing schooner displayed in London at the fisheries exhibition of 1883, and afterward purchased by the prince of Wales. Her sails are set, and on every side are groups of fish, with modern implements and gear of every kind, in contrast with which is the primitive fishing apparatus of Canadian Indians. Of seals there are several specimens facing the central nave, and of shell-fish there is no lack, with oysters, clams, crabs, and lobsters of remarkable size and quality. Here also is the largest devil-fish ever placed on exposition, and to fish products, as oils and skins, is given a conspicuous place.

The entrance to the principal court is in the form of an archway composed of canned fish with bottled goods inside the pillars, and at the top a panel formed of fish products. The interior is draped with netting, flags, and bunting, and on the columns are the dominion and provincial coats of arms. In the southern gallery Canada has also several sections, and here again in scores of cases are numerous specimens of mounted fish and fish-destroying birds, but without a single duplicate. Fish, fish stories, and fishing scenes are likewise portrayed in graphic art. But here the centre of attraction is a model of a fishing station, with coast line and piers, warehouses, stores, and dwellings, resembling a sea-port town in miniature. Finally it may be said that the entire exhibit is in all respects worthy of the dominion, one on a larger and more comprehensive scale than any before attempted, and yet, as is said, with an overflow of specimens offered for exposition that would have filled at least one-half of the Fisheries building.



MODELS OF RUSSIAN BOATS



COLUMN OF FRENCH SARDINES

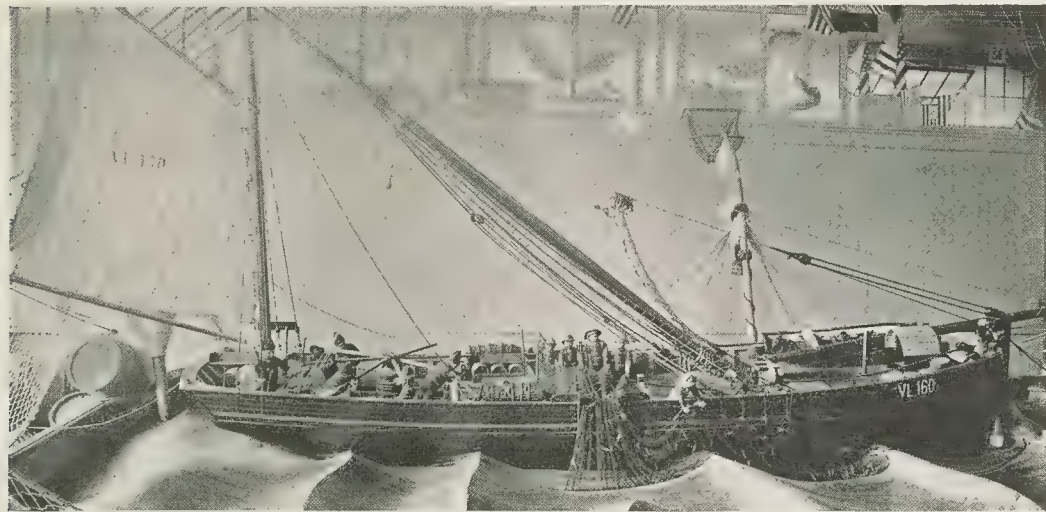
ment; for while less elaborate than that of the dominion, the majority of visitors will here for the first time be informed as to the vast resources of Australian fisheries. Many of the specimens are taken from the waters of Sydney harbor and the grounds adjacent, where are some of the most prolific fisheries in the world. Among the principal food fish are the schnapper, bream, rock-cod, gar-fish, mullet, mackerel, and whiting. The first is a favorite pan fish, with firm, white flesh of excellent flavor, and weighing when full grown from six to nine pounds, though twenty-pound schnappers are by no means rare. It is found in vast shoals along the entire

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eastern coast of the southern continent, and is one of the most voracious of fish, greedily seizing the bait, and taken by hook and line at all seasons of the year. The bream is second in flavor only to the schnapper, and by many the gar-fish and the red and black rock-cod are preferred to either. Of mullet there are several varieties, the sea mullet resembling the Scotch salmon in taste and fibre, and of astonishing fecundity, the roe of the

female containing more than 2,000,000 eggs. About Christmas week—the Australian midsummer—and for several weeks thereafter, the expanse of ocean is partly covered by migrating schools of mackerel. The whiting has no affinity to the European species, but is of superior quality, and when lightly cured and smoked is esteemed as a table delicacy. Then there are the coarse grained jew and king-fish, the salmon, unworthy of its name, and of which only the roe is eaten, the herring, of excellent flavor but little used for food, the perch and flat-head, the latter with white, flaky flesh, the



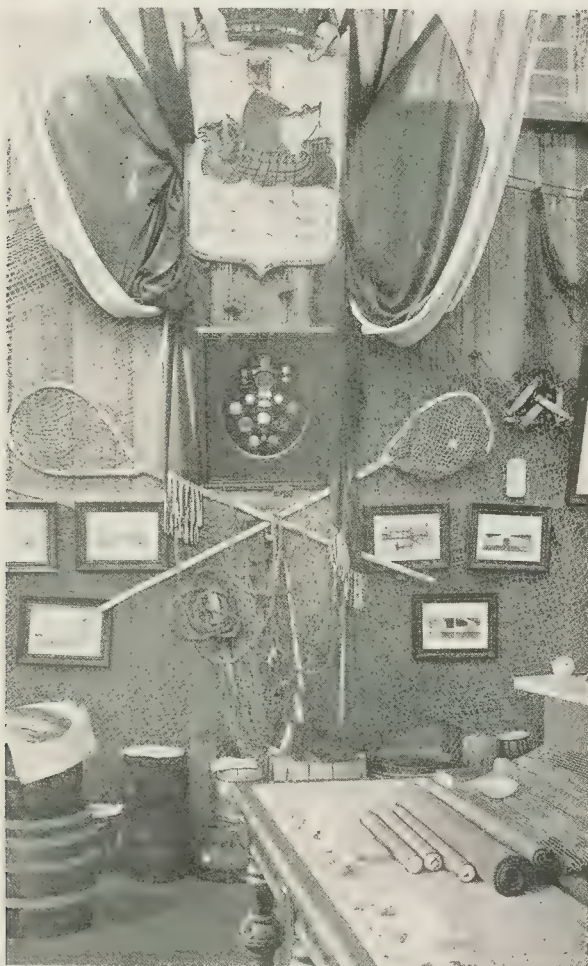
HERRING FISHING BY THE DUTCH

flounder and sole; while among crustacea the cray-fish is not inferior to the American lobster, and oysters and other mollusks abound in every bay and inlet.

With all this wealth of fisheries it is somewhat remarkable that New South Wales imports from abroad more than three fourths of her entire consumption, about \$200,000 representing the value of fresh fish sold in Sydney markets against \$650,000 worth of imported fish preserved in various forms. This is due mainly to high prices caused by the rapid depletion of the grounds within and adjacent to Port Jackson, for as a rule the colonial fisherman will not venture more than a mile or two from Sydney heads, and experienced sea-going fishermen supplied with modern implements are almost unknown in Australian waters. The appliances used are the same as did service half a century



TANNED FISH SKINS, RUSSIAN SECTION



RUSSIAN FISHING NETS

ago, and the field is still restricted to grounds that have been worked for several score of years, a seine and meshing-net with a rickety open boat forming the entire outfit. There is not a fishing steamer or even a fishing smack in all the Australian colonies, and apart from the most primitive apparatus, there is no provision for deep-sea fishing of any kind. Here in truth is an outlet for foreign capital and enterprise, one capable of infinite development and offering sure and speedy returns; for while there is no country in the world with richer resources in this direction, there is none where these resources have been so much neglected and mismanaged.

To make known the latent wealth of Australian fisheries, their products, methods, and results, was the special object of the colonial government of New South Wales. To this end are shown several groups of canned goods, and of marine and fresh water fish preserved in alcohol, as schnapper, whiting, rock-cod, flounder, gar-fish, flat-head, and an assortment of dried fish and fish oils. There is also a large display of pearl and oyster shells, some of the latter



GIANT CRAB OF JAPAN

fish are preserved. The remainder of the space is largely devoted to the sardine fisheries, one of the exhibiting firms constructing pyramids of packed sardines; in the background a fishing scene is represented in graphic art. Nets, with a single model of a boat and a collection of gold medals, complete the private exhibits. From the government is an exposition of the national fisheries, with statistics, plans of hatcheries and grounds, and a chart showing the annual production of oysters.

Germany has a small and compact exhibit in the southwestern corner of the building, consisting largely of models of fishing craft, fully equipped and rigged, and of schooners and steamers used for conveying fish to market. One of the groups consists of fish guanos and chemicals, and another of fishermen's houses, fish markets, and their appurtenances. There are also pounds, traps, apparatus for transporting fish, and maps and diagrams showing the coast line of sea fisheries. A Munich firm has a large collection of hooks, lines, and spinners, and from Holstein come netting, baled rope, seines, corks, oars and prongs, buoys, and a model of the cutters used in the North sea. Another firm sends neatly bound volumes on the fishing industries of Germany, and there are large photographs of German scenery and of factories for the preparation of fish products.

In Russia, with her vast extent of coast and inland waters, the fisheries are of great economic value, far exceeding those of France and Germany, neither of which produce as largely as the dominion of Canada. In the White sea and on the northern coast of Norway several thousand tons, including more than 100,000,000 herring, are captured by Russian fishermen.

In the sea of Azoff and on the lower Don about 20,000 men are employed, with other thousands among the estuaries of rivers discharging into the Black sea. But the principal fisheries are on the Caspian and its tributaries, those of the Volga and its delta extending over an area of 6,000 square miles, while from the Ural fish are taken for 400 miles along its stream, the total catch exceeding 200,000 tons, worth at least 15,000,000 roubles. Within recent years a large station has been established at the Seenemorskoi fisheries on one of the mouths of the Volga delta, a region before uninhabited, and now supporting a flourishing settlement, with steamers, barges, lighters, and hundreds of fishing boats; with warehouses, stores, and barracks; schools, libraries, and hospitals, and all the adjuncts of a substantial and prosperous community. An average season's take is valued at 2,500,000 roubles, the catch consisting mainly of herring and dace, but including nearly a score of varieties.

clinging to bars of iron as found in ocean's bed, and in another group are fish fertilizers and soaps. In cases on either side of the court are mounted specimens of fish-eating birds, as the fish-hawk, cormorant, shag, large-billed bittern, gray heron, and sea-gull. A careful collection has been made of the reptiles of the colonies, and of these there are many hundreds preserved in alcohol. Australian smoked fish occupy a large space in the rear of the section, near which are cabinets of shells, reptiles, and marine fish from the Sydney museum.

On the left of the court is a small yacht, made of Australian wood, equipped as a pleasure craft for amateur fishermen, and near the entrance is a model of a twenty-two foot fishing boat. The west wall is covered with a series of paintings of marine fish, and at either end are handsome photographs of the fish market at Woolloomoolloo, a suburb of Sydney. On the east wall are choice paintings of salt-water fish by a prominent Australian artist, and at the portal is a trophy in the form of a lighthouse, composed of canned goods. Seals disporting on rocks in the centre of the court form an attractive group, and colonial flags and banners are among the decorative features of the display.

France occupies but a narrow space in the Fisheries department, between the British and Canadian sections. One half of the enclosure is occupied by exhibits of canned fish, mainly sardines and anchovies, with photographs illustrative of canning and other processes, among them the preparation of the olive oil in which the



DRIED FISH, JAPANESE SECTION

In the Russian section, fronting on the rotunda and central nave, are specimens of fish, fishing craft, and apparatus from all the more prominent grounds throughout the wide domain of the czar. From the Caspian come models of full rigged vessels, and from the Astrakhan board of trade, typical Russian fishing boats, including such as ply on the Volga, and convey the fish to market. There are the fishing garments worn in various localities, with appliances for sporting fishermen, and a collection of seal-skins and articles made therefrom by the monks of the Solovetzky monastery at Archangel. Then there are numerous devices for catching fish, as hooks, nets, and traps, with the machines for making them, and the tin fish used for decoys by inland fishermen.

In rear of the pavilion is a large column of canned goods from a St Petersburg firm, adjacent to which are cases of anchovies and an assortment of sturgeon in varied forms, with caviare, isinglass, and other industrial

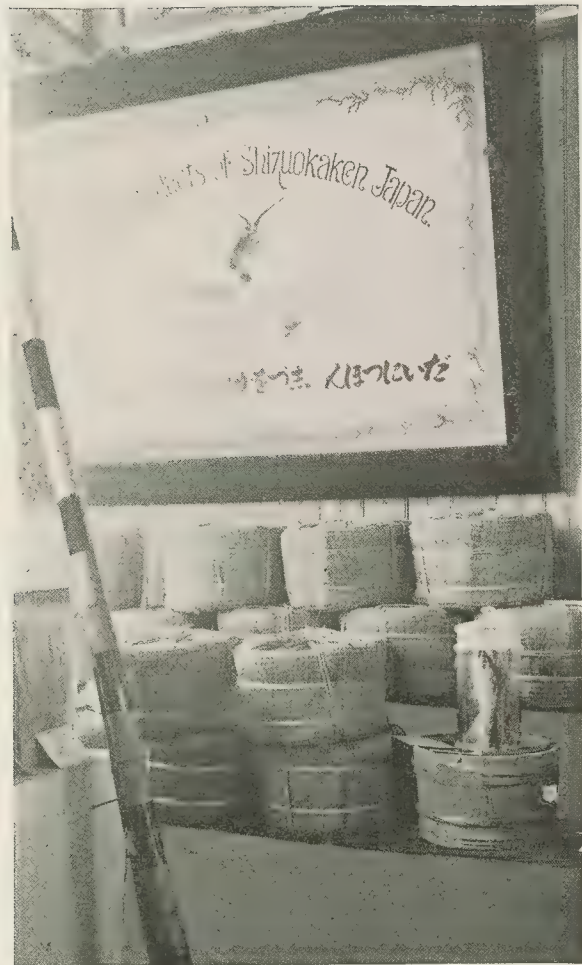


PORTION OF RUSSIAN SECTION

products. Of the specimens of fish-oils those from the Caspian sea rank first in commercial importance. Diagrams, charts, and maps are numerous, showing the location of the principal fishing grounds, and with statistical data as to the Ural Cossacks. A scene on the ocean shore, with hundreds of fishermen awaiting the signal to start, and a midwinter fishing scene on the Ural river are among the choicest photographs in this section, above which are suspended the Russian coat of arms and imperial crown, flags and netting forming the drapery of the pillars, while from the ceiling depends a large open trap-net serving as a canopy for the court.

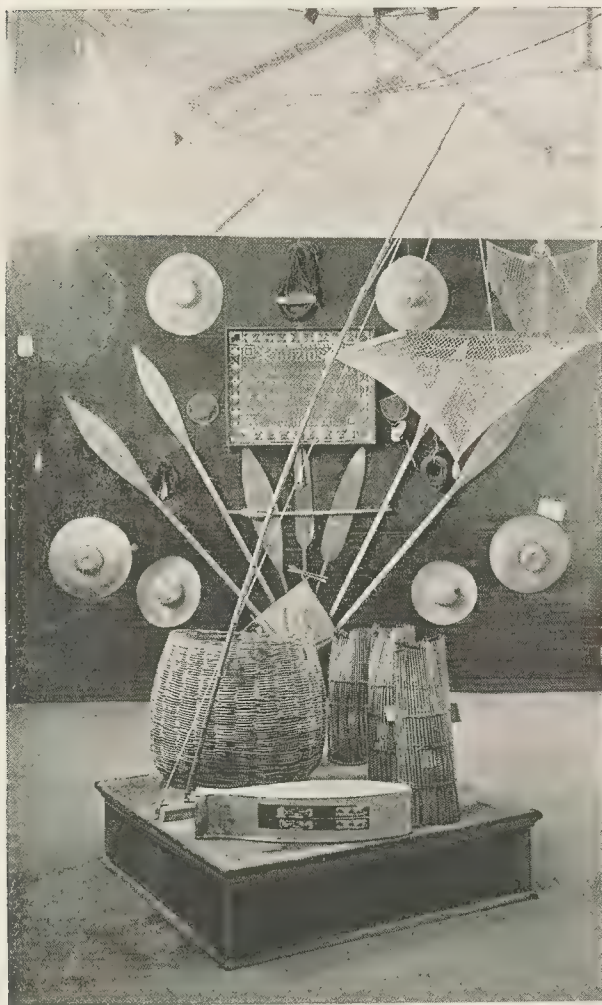
The Netherlands, with their extensive fisheries, the herring catch of the North sea alone being valued at several million guilders a year, occupies but a narrow space in this department of the Fair. The feature of interest is a model of a herring schooner fully equipped, with the Dutch flag at the mast, the captain on the bridge, and the men in the act of hauling in the net, the vessel floating on a turbulent sea. Around it are samples of herring, gill and drift nets, hand-lines, signal-flags, and other fishing and nautical apparatus.

Greece completes the list of European participants, her section in the southwest corner of the gallery containing an elaborate collection of sponges from prominent Athenian firms. These are of every conceivable shape, some resembling articles of wear or household use, others in crude form, clinging to pieces of rock and



CORNER OF JAPAN SECTION

masts, with cross-piece of oars and drapery of netting, are long tiers of shelving, containing specimens of fish in all the forms of preparation peculiar to the Japanese. There are numerous samples of canned goods, as salmon, smoked herring, oysters, halibut, tai, and a large variety of such delicacies as oyster sauce, sea-urchin paste, and sharks' fins prepared for soup.



BRAZILIAN NETS AND FISH-TRAPS

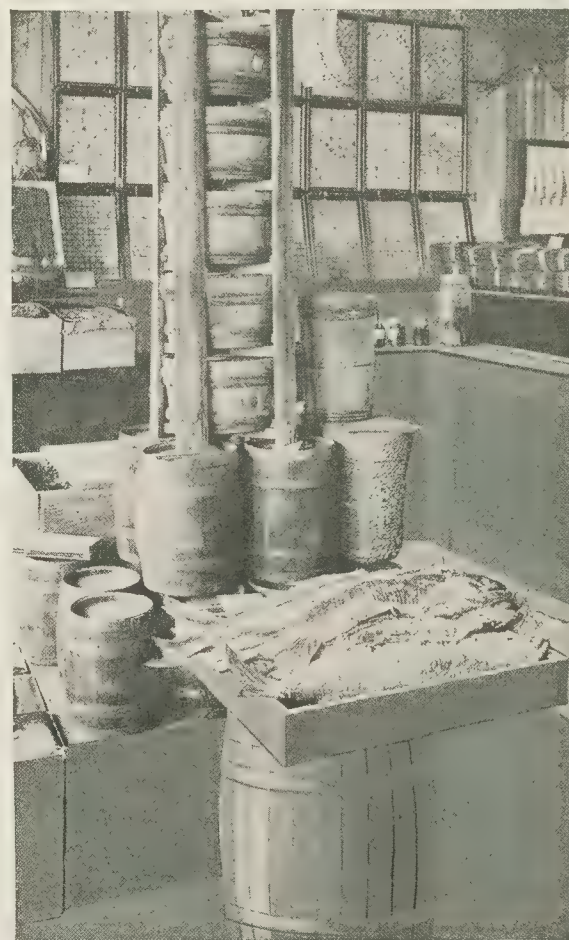
shell or partially covered with fungi. There are specimens thirty inches in diameter, and many of the same width, but almost as thin as the leaf of a water lily. In front of the enclosure is the national flag, and above the archway are displayed the coat of arms and crown of modern Greece.

Mexico has a tasteful exhibit adjoining the northern portal of the Fisheries building; and nowhere in the department are sea-shells and scale-work of more beautiful and varied hues. The specimens of fish, while the list is not large, are also of wondrous shades of coloring, and some of them of most fantastic form. Many are in a preserved state; but there are also assortments of dried, canned, and pickled fish, including the turbot and shrimp. In cases of steel and glass are sponges from Pacific and Atlantic waters, and pearls and fresh water shells, with articles of bric-a-brac made therefrom, in contrast with which are the bones and skin of the sea-cow. Around the enclosure are fish-traps, nets, oars, gigs, gaffs, spears, and fishing-rods. Yucatan's contribution consists of a sea-wolf weighing about 1,000 pounds, and in the rear of the pavilion is a sea-turtle more than five feet in length and as broad as long.

In a spacious enclosure fronting on the northeastern aisle Japan has arranged her exhibits with method and decorative effect. On the outer sides of the entrance-way where are Japanese

Fish scrap is shown in rope-bagging made of the stringy portions of dried lobsters. Guano from fish products, dried sea-ears, and soup extracts in bottles, boxes, and jars form another group, while blocks of wax from whale, sardine, and herring products are some of the materials of which Japanese candles are made. To illustrate their methods of sardine fishing and preparation for market, a number of pictures are interspersed among the exhibits. A collection of large photographs shows Japanese vessels in pursuit of the cormorant, and an oyster fisherman's village fashioned of bamboo, while the shark, cod, salmon, gold-fish, and many rare oriental species are also reproduced in graphic art.

In one shape or another, nearly all the products of Japanese waters are here displayed. Mackerel, white-fish, sardines, plaice, bonita, cod, and dolphin are shown in forms prepared for table. In bottles there are well preserved specimens of fresh and salt-water fish, including the flying-fish, gold-fish, ox-tail, and red-scorp. In alcohol are the Japanese star-gazer, black-perch, toad-fish, and carp, while shrimp soup in bottle, shrimps boiled in sea-water, abalone made into a relish for breakfast, smelts preserved in wine sediment, dried anchovies, and boneless herring, are a few of the



JAPANESE EXHIBIT

luxuries displayed in this section. The group of sea and spider crabs is worthy of mention, and the lobster without claws is somewhat of a novelty. Many articles of commerce are also on exposition, as paper made of sea-weed, scrap for fertilizing, and herring, sperm, whale, and other oils for various purposes.

In Japan all varieties of sea-weed are utilized, the yellow sea-weed being made into isinglass, of which

the samples resemble the product of Irish moss. From other forms are shown specimens of jellies, salads, and gelatine, while from the more valuable grades is made a preparation highly prized for soups and extracts. Boneless cuttle-fish, of which there is a considerable export, are displayed with the bones at their side in the form of small shot, used by the Japanese for canary shooting. Oyster shells of remarkable size, pearl shells in profusion and of beautiful tint, and the largest collection of small sea-shells in the Fisheries building are arranged in attractive groups.

The exhibit illustrating Japanese methods of capturing and preparing fish forms the central feature of the court. Here oddly-shaped fishing and



SHOWING WESTERN ANNEX FISHERIES BUILDING

angling boats are shown in miniature, with nets and outfit to match. Different varieties of nets, for herring, salmon, sardines, and tunny-fish are side by side with models of pound nets. Here also is a collection of curious fish-hooks, bait, flies, and trawls. Resting on a miniature ocean is a small fishing-boat, the crew of which are watching a number of decoy ducks fastened to their craft and floating on the water. A model of a furnace, with apparatus for curing fish, and an assortment of fish knives, represent Japanese modes of preparing fish for food purposes, while for extracting oils and converting the scrap into fertilizing substances, there are the old-fashioned hand-press and modern machinery, both in the form of models.

Entering the western annex from the main building, the first exhibit is that of the fish commission of Pennsylvania. In the centre of its pavilion is a miniature

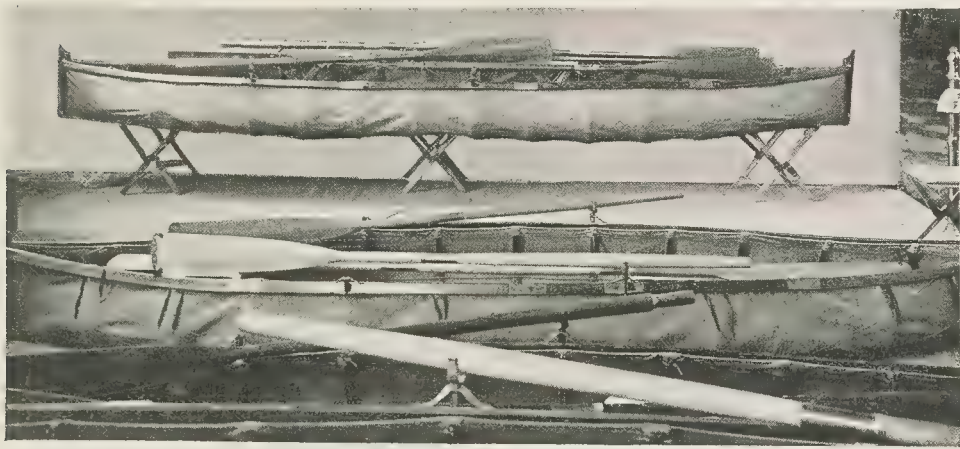
grotto, with a cascade descending into a pool below, and beneath the waterfall, a weir showing the method of catching mountain trout. In the pool are several fine specimens circling around the rocks and river plants, which give to it the appearance of a natural fish-pond. Surrounding the grotto are long rows of tanks, in which, swimming in their several aquaria, are most of the fish that frequent the waters of the state, including the sturgeon, pike, perch, trout, carp, cat-fish and



CROCODILE OF THE AMAZON

gar-fish. Aquatic birds are freely displayed, and there are photographs and models of hatcheries and fish-ways, with modern piscicultural processes in actual operation.

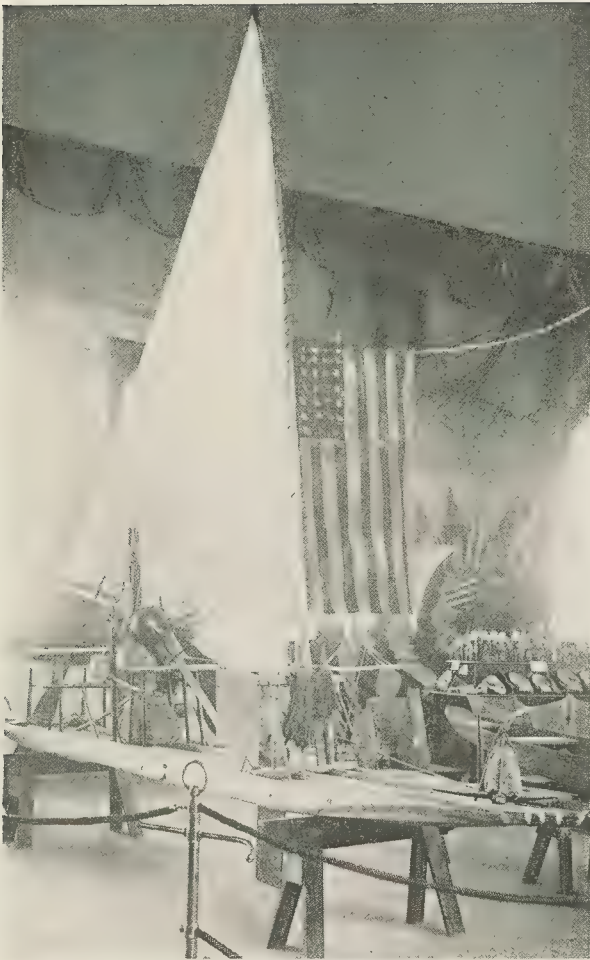
Wisconsin occupies the adjacent section, and here are fully illustrated the excellent results attained by the state fish commission. In a series of tanks are displayed, among other specimens of native fish, the small-mouthed black-bass, sun and gold-fish, carp, rainbow-trout, cat-fish, bull-head, pike, and sturgeon. Statistics and other data are arranged in interesting form,



MODERN FOLDING BOATS



VIEW FROM LOGGIA FISHERIES BUILDING



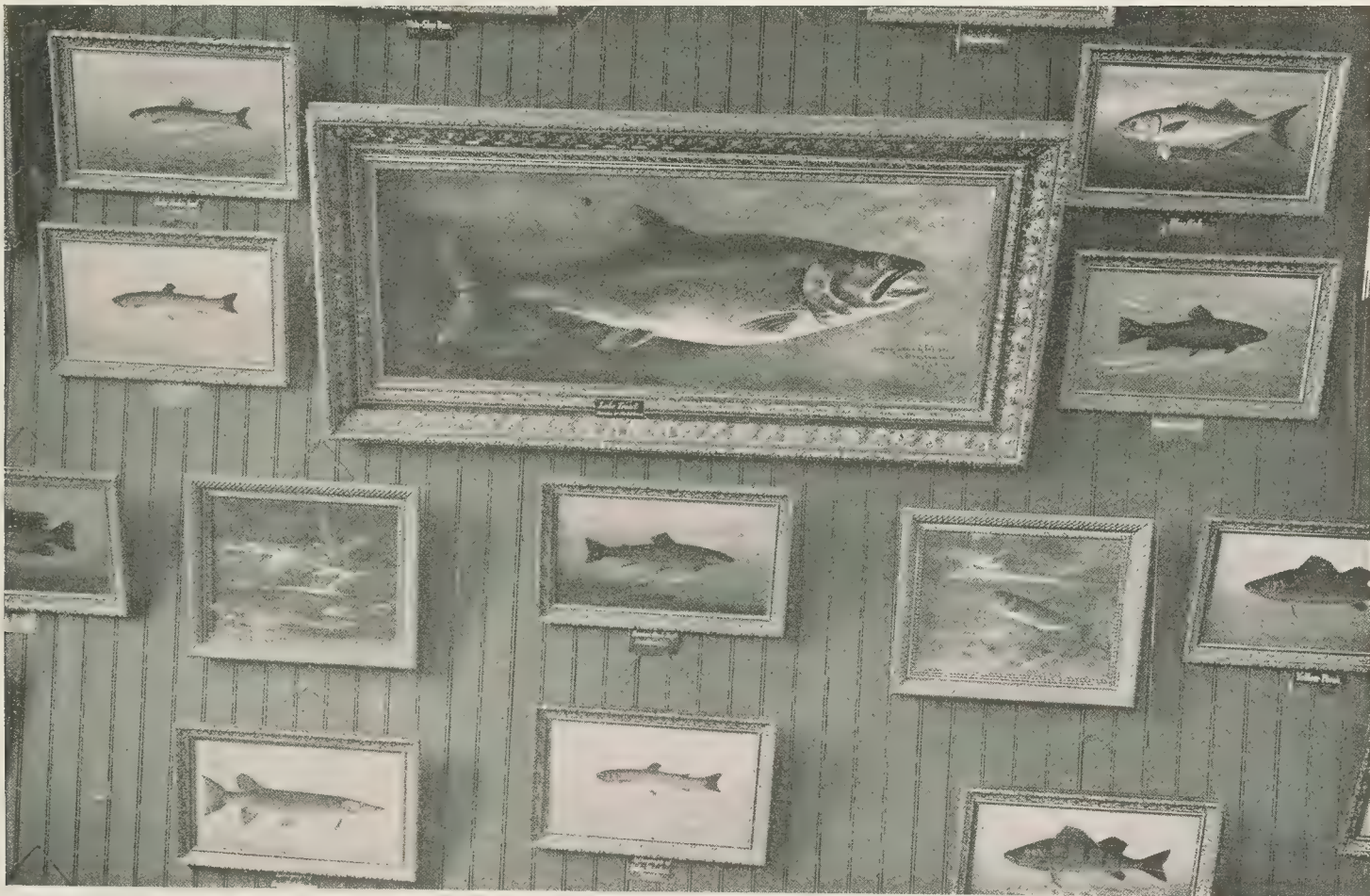
BRAZILIAN JANGUADO

and aquatic plants artistically grouped add to the realistic appearance of the scene.

Across the aisle adjoining is the Brazilian exhibit, an interesting collection of the primitive fishing implements of native tribes, near which are the tackle and appliances to-day in use on the Amazon and other fishing streams. From Paria comes a peculiar type of fishing-boat, and from a botanical museum a collection of canoes made of bark and dug-outs hewn from a single log; but the most remarkable among the fishing craft is a specimen of such as ply on the waters of Pernambuco harbor and neighboring ports. In shape it resembles a raft made of logs, and is without compass or rudder, but will safely carry its crew far out to sea, or through waters where an ordinary boat would be swamped. Another unique exhibit is of the implements with which the ganoidal order of fish are caught by spearing them between their angular scales. In one of the cases is a collection of sponges, ornamental specimens, canned goods, fish-oils, and reptiles, some of the last of brilliant hues.

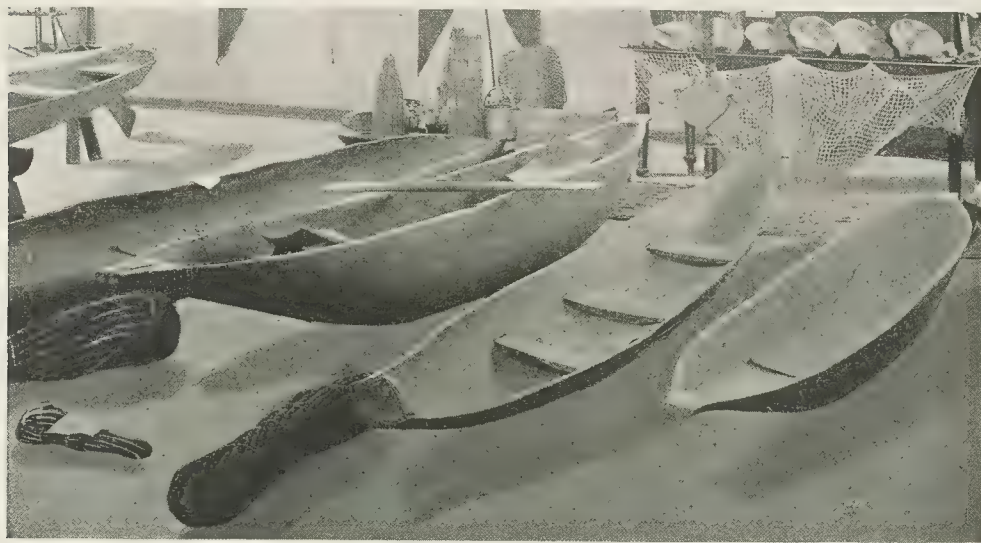
In the next section are paintings of American game-fish, algæ, and other forms of sea-life, with some choice paintings of the auk, an aquatic bird which has practically become extinct. One of the latter represents the bird's egg in life size, and in graphic art are reproduced scenes on and around Funk island, off the coast of Newfoundland, where was its breeding ground. Here it may be mentioned that, some years ago, Captain Collins, chief of the Fisheries department, gathered on this island more skeletons and bones of the auk than are possessed by all the museums in the world. An oil painting of the well-known fisherman Reuben Wood shows him with rod and reel in the act of casting a fly.

Near by a Chicago firm has a display of row and sail boats, with a seamless canoe made of a substance called linenoid, and an odd looking duck-boat almost as flat as a board, but warranted to "run wherever it is a little damp." A firm doing business in Racine, Wisconsin, shows a collection of fishing camp apparatus, and an Evanston exhibitor, a fac-simile of the tent ordered by Lieutenant Perry for his expedition to the North pole. A Clayton, New York, establishment occupies a considerable space with a St Lawrence skiff and a number of canoes, row-boats, and yawls, one of which cannot be capsized, and, though not more than twenty-five feet long and with four-foot beam, weighs, with its ballasting, over 500 pounds.



PAINTINGS IN THE ANGLING PAVILION

By an Ohio and a Michigan firm are exhibited folding boats for amateur fishermen. Though dissimilar as to pattern, the general make up of the vessels is the same, consisting merely of canvas, with an oil coating which renders them impervious to water, drawn over a frame-work, and so arranged that the frame can be taken out and the canvas wrapped around it, forming a handle which a man can easily carry, the entire equipment weighing only fifty pounds.



AMAZONIAN DUG-OUTS

stories, and other interesting matter. Other features are the canoe of the patron saint of sportsmen, a model of the yacht *Gloriana*, and an assortment of Kentucky reels, none of them less than fifty years old, contributed by J. A. Henshall. A gun taken from a poacher at Yellowstone park by the editor of this periodical is one of the curiosities of the display. By the *American Angler* is also exhibited a fine collection of paintings of all the fish taken in American waters.

In the centre of the building are several private collections of rods, some with double enamel finish, of reels, tackle, hooks, landing-nets, and other articles pertaining to the craft. From Rochester comes an exhibit of automatic reels, while a Chicago firm displays its kosmic rods, some of them mounted in gold and silver. Another Chicago exhibitor has fishing-tackle with bell attachment, so that, when the fish bites, the alarm is given. By one of the participants are shown several machines in operation, manufacturing silk fishing-lines, 576 threads of raw silk being used for the making of a single line the thickness of an ordinary thread of worsted. In the angling section proper, an article never before on exposition is in the form of a flanged, flint-glass tube, in which is placed a live minnow for bait, and with a hole in the end to admit the water and to keep the fish alive.

The New England states make a fine display of the various appliances used in the fishing industry, including baits, lines, weirs, seines, and pound, purse, and gill-nets, the last showing how mackerel, herring, and cod are taken. Ohio has stuffed specimens in alcohol of all her principal fish, with aquatic birds peculiar to the state, and from the Cincinnati society of natural history are specimens of the smaller species, with all manner of aquatic insects. In the Missouri section is a complete display of indigenous specimens, including pickerel from the streams and lakes, striped-bass, German carp, small-mouthed bass from the Black river, paddle-fish, crappie, silver-bass, black-gilled sun-fish, sheeps-head, black-buffalo, sturgeon, tench, and cat-fish from the Missouri.

The Chicago fly-casting club, as a part of their exhibit, have reproduced on the shore of the north pond Izaak Walton's fishing cabin as still it stands on the banks of the Dove. From a manufacturing

Forest and Stream has one of the most attractive exhibits in the annex. It consists for the most part of photographs of hunting and fishing scenes, forming a collection of prize competitive work from all parts of the United States. The largest tarpon ever caught, weighing more than 200 pounds, is here on exposition, together with the apparatus by which it was captured; and by way of decoration are the heads of moose, buffalo, and mountain-goat, with gill-nets, rods, lines, and flags arranged in artistic forms. In a handsome case are files of the *Forest and Stream* from 1874 to 1893, with works on hunting and fishing, fish



DISTANT VIEW OF FISHERIES BUILDING

company of Chicago is a display of artificial flying-fish, with the process by which they are made, and among other articles, one of the finest collections of flies in the western annex.

WORLD'S FAIR MISCELLANY.—In the decorative scheme of the Fisheries building there are some daring features, showing that the artificer has given rein to his fancy, and yet with pleasing effect. For the capital of one of the columns, for instance, a lobster-pot suggested a design in which is found nothing inappropriate. Over one of the door-ways is a group of sportive frogs, joined hand in hand in dance. Elsewhere the purposes of the building are freely sug-



COD FISH FROM THE LOFODEN GROUNDS

gested by its decorative themes. Around one pillar is a procession of sea-horses, and others are covered with star-fish, lizards and eels, lobsters, crabs, and turtles, with pisciform balustrades, the heads of fish resting against the railings, and their tails interlaced below.

Among individual exhibits not mentioned in the text are a couple of St Lawrence skiffs in the northwest corner of the gallery. These are from a Canadian boat firm, and are built of the finest wood, with nickel-plated rowlocks and bolts. Across the aisle from California's section is a private display of canned goods, as clams, clam bouillon, and sturgeon. In the north gallery a Wyoming inventor shows a device for conveying small fish alive to market, and near by is a private collection of birds, shells of all kinds and colors, corals, fossils, and marine curiosities.

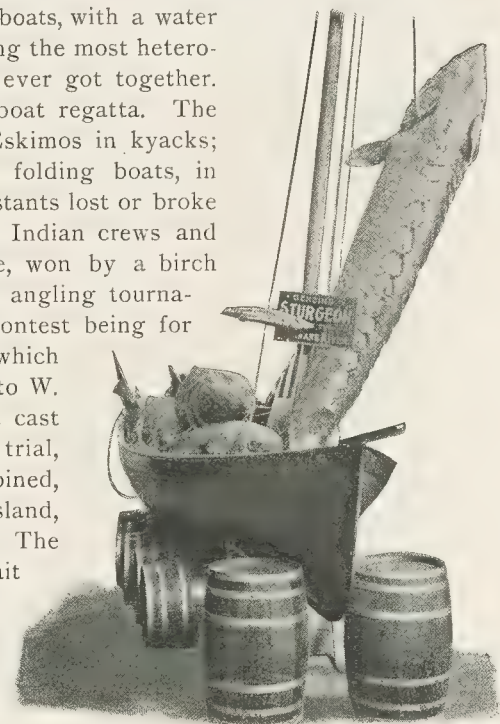
The collection of Kentucky reels in the *Forest and Stream* exhibit is of special interest, as showing all the improvements made in this direction, for more than half a century, in the state where multiplying reels were first invented.

Between the 19th and 22d of September was held the fishermen's congress, with contests among fishermen for which prizes were awarded. After the session on the 19th the members dined together and then attended the procession of fishermen's boats on the lagoons. In front of this procession was a square-rigged whale-boat, followed by small craft representing all nationalities, including yawls from the Columbian caravels manned by United States marines and Spanish sailors. There were Eskimo kyacks, Ceylonese outriggers,

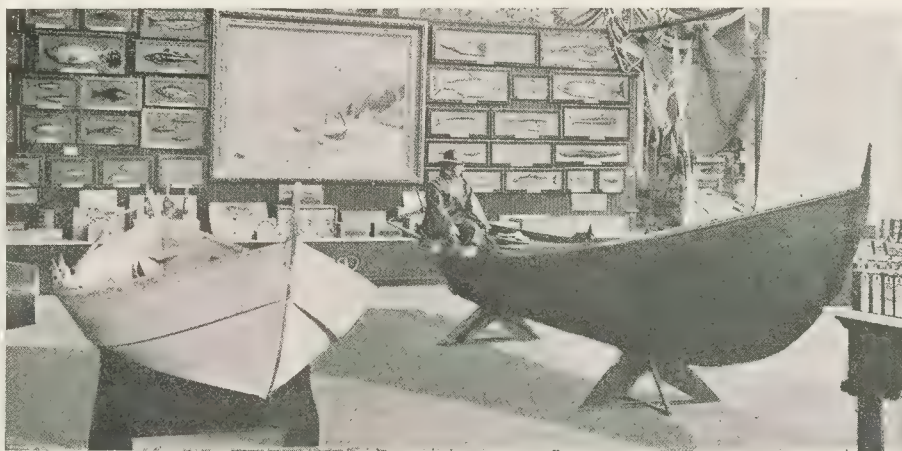
Norwegian fishing-boats, lobster dories, racing shells, canoes, canvas folding boats, with a water bicycle and other craft, forming the most heterogeneous collection of vessels ever got together. On the 20th there was a fish-boat regatta. The first race was between two Eskimos in kyacks; the second between canvas folding boats, in which three of the four contestants lost or broke their oars; the third was for Indian crews and the fourth, a free-for-all race, won by a birch bark canoe. On the 21st an angling tournament was held, the opening contest being for long distance fly-casting, for which the first medal was awarded to W. H. Babcock, of Chicago, for a cast of 76½ feet. In the second trial, for distance and accuracy combined, H. G. Leavitt, of Grand Island, Nebraska, was the winner. The third test was for black-bass bait casting, and this also was won by a Chicago man, E. E. Wilkinson. On the following day the tournament was continued, this part of the programme being conducted under the auspices of the Chicago fly-casting club. On the 19th of October a banquet was held by the congress in the New York state building.

Until recent years fish skins and bones were removed from the premises of packers and merchants at their own expense. Cod, cusk, and other skins are now worth \$25 to \$30 a ton, this value resulting from an invention patented by John S. Rogers in 1873. While trying in vain to convert fish waste into fertilizers, he noticed a gummy substance adhering to the skins which he handled, and then it occurred to him that glue or isinglass could be made of them. Offering a few cents a barrel for skins, kept apart, he went to work, with the results indicated by the exhibits of the Gloucester company.

For several years the mackerel fisheries of New England have shown signs of depletion or desertion, due as some have it to the purse seines largely used since about 1875, before which date only the larger fish were taken by hook and line. Of lobsters the catch was also largely decreasing, through want of protection, only some 250,000 cases being canned in 1892, against twice that quantity for 1890. Halibut were growing scarcer every season, though the deficiency was partially made up from Icelandic fisheries, whence more than 700 tons were taken by American craft in 1891, notwithstanding legislative prohibition. Herring showed no signs of decrease, 24,200,000 of these fish being handled in Boston markets alone. Of haddock the largest take recorded was in February, 1891, when a



DISPLAYED BY WASHINGTON STATE



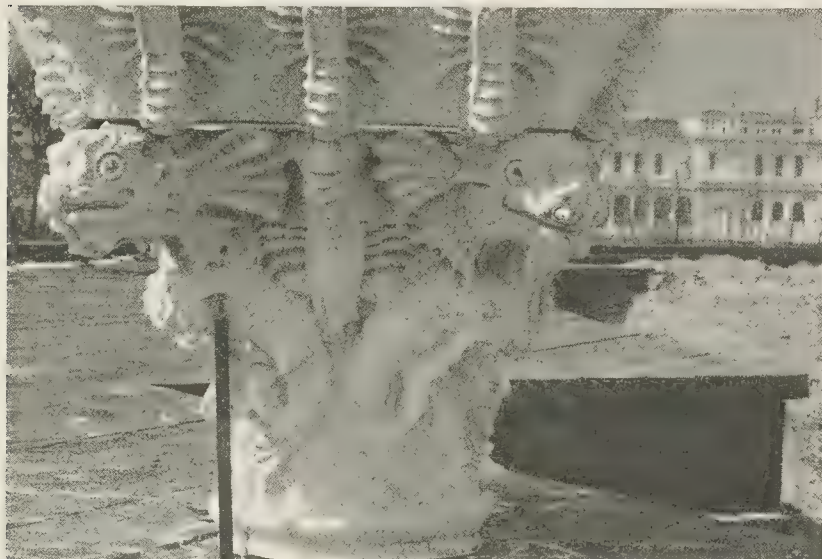
FISHING BOATS OF TO-DAY

schooner caught on the Cape Shore grounds 132,000 pounds, besides an equal quantity of other fish.

An acre of good fishing-ground, it has been said, will produce

more food than an acre of the best farming land. This is as true to-day as it was two or three centuries ago; for except in a few vari-

fish store was opened in 1807, and the first fresh fish store in 1835, averaging more than \$15,000,000 a year.



OUT-DOOR EXHIBIT

eties there has been no very serious diminution in the supply of fish in United States waters, and all the species found in pilgrim times exist in abundance to-day. Meanwhile our fish trade has grown to enormous proportions, that of Boston, for instance, where the first

During the cod-fishing season at the Lofoden islands, in the months of February and March, the average catch is about 30,000,000 of fish, and of such importance is this industry that the number taken each day is telegraphed to all the principal cities in the kingdom. On a picturesque harbor in the heart of these islands is the town of Stamsund, where are the cod-liver oil works of Peter Möller, described in Paul B. du Chaillu's *Land of the Midnight Sun*. By Möller was originated the steam process of preparing this oil from fresh, clean, healthy livers, and without nauseating smell or taste. When the midnight sun appears in all his radiant splendor, illuminating some of the most romantic of Norwegian scenery, the islands are visited by thousands of tourists. Here snow-clad peaks rise in almost perpendicular lines for thousands of feet above the ocean. For most of the year the ravines are filled with snow, and thence numberless streams descend in foaming cascades to the fjords below.

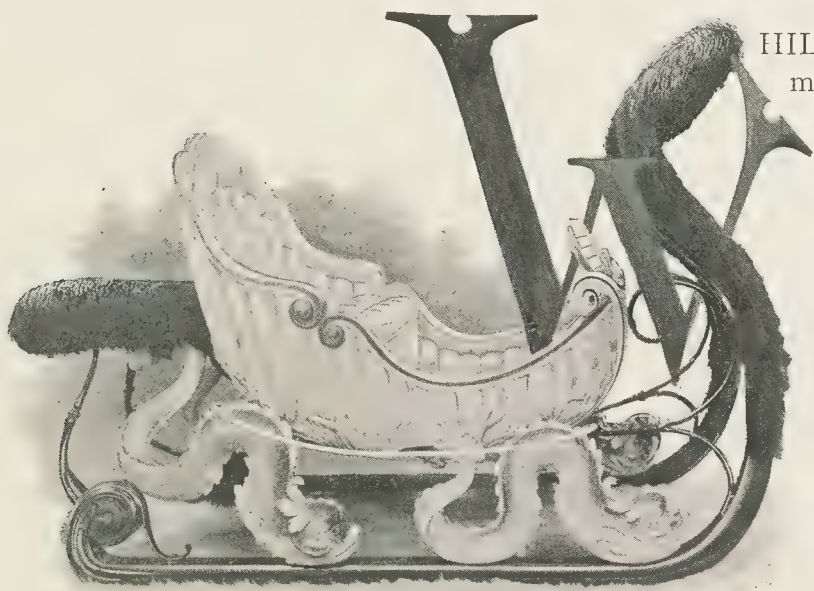
The edible sea-weed mentioned in the Japanese exhibit is dissolved, when boiled, into a glue-like liquid, but of palatable flavor. When used for soup it is cut into shreds which resemble curls of light, fluffy hair. For one purpose or another the Japanese use almost every form of sea product. The octopus and squid are eaten, and the toad-fish is prized for its medicinal properties, the soup made therefrom being freely used by invalids. All these are on exposition in this section.





CHAPTER THE EIGHTEENTH

TRANSPORTATION



WHILE here and there exception may be taken to the arrangement and combination of exhibits, as the grouping of musical instruments in the department of Electricity, and of mail-bags and Leghorn hats in that of Liberal Arts, it is generally conceded that the entire Exposition and each of its divisions and subdivisions have been planned with consummate skill. And nowhere is this more apparent than in the Transportation building. Here, as elsewhere, but here especially are features that claim the attention of every class of visitors; and as the chief of this department states, "Among its main purposes was to fascinate and attract by the presentation of the most striking contrasts; to educate by showing the wonderful achievements of engineering science, and the great results developed from apparently simple discoveries and inventions."

Whether for study or for the mere gratification of curiosity, the exhibits grouped in this department are of surpassing interest; for here is presented in most attractive form a complete history of all the known methods and appliances for travel and transportation, barbarous, semi-barbarous, and civilized, from the pack-animal to the vestibuled train, and from the dug-out of the savage to the swiftest of trans-atlantic steamers. In no branch of human endeavor, except in the application of electric power, has such progress been made as here is shown, and nowhere than in this country of magnificent distances has the annihilation of distance been more nearly approached. Yet achievement thus far is but a foretaste of that which is to come; there are those now living who may journey by rail from Paris, possibly without change of cars, to a great world's fair to be held, let us say, in New York, toward the middle of the coming century.¹

The connection of the railroad systems of the world by way of Bering strait is by no means the chimerical project that some would have us believe, nor one that may not ere long be accomplished.





LOOKING TOWARD THE GOLDEN DOOR

architectural symmetry and proportion were made in a measure to give place to considerations of practical utility, that except for the Fisheries building, its width, in relation to length, is smaller than in any of the principal structures, and that its exterior aspect differs essentially from all the rest.

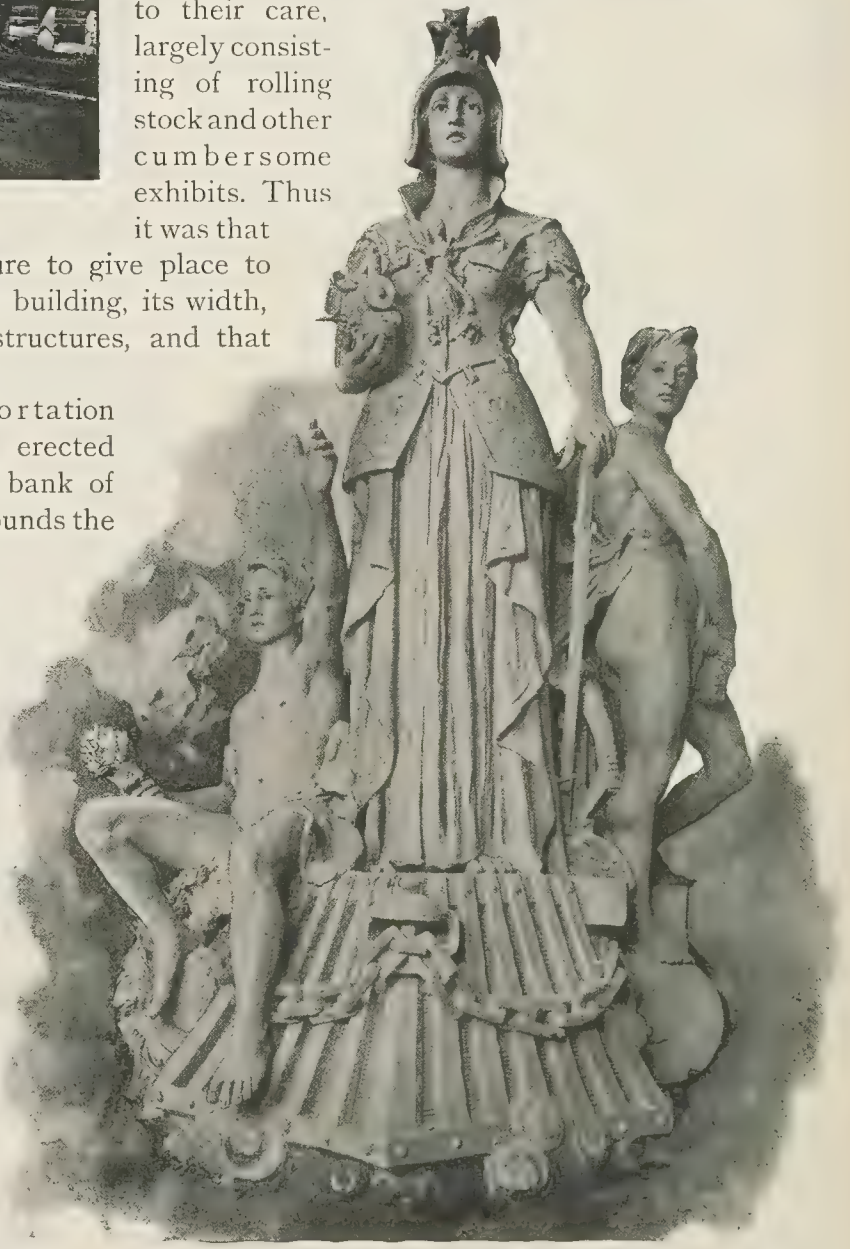


FIGURES BY BOYLE

The Transportation building proper was erected on the southwestern bank of the lagoon which surrounds the wooded island forming a portion of the Horticultural grounds. Opening into it and covering a larger area is the annex, extending westward almost to the limits of the park, and in which are the principal railroad exhibits of the United States, Great Britain, and Canada. In the main façade, separated by the lagoon from the hall of Manufactures

"Of all inventions," remarks Macaulay, "the alphabet and the printing-press alone excepted, those inventions which abridge distance have done most for the civilization of our species." Such appliances are in truth the prime factors of commercial and industrial growth, and never before was such an opportunity for observing their development in all their manifold stages.

In structural design the Transportation building, with its spacious annex, is one of the simplest and most unassuming of all the Exposition edifices, and yet with a richness of decorative forms that relieves it from poverty of design. But in covering the allotted space of fifteen and a half acres, its architects, the Chicago firm of Adler and Sullivan, had first to consider the character of the display whose housing was to be intrusted to their care, largely consisting of rolling stock and other cumbersome exhibits. Thus it was that



STATUARY TRANSPORTATION BUILDING

The bridging of that shallow strait by way of the Diomedé islands, almost in the middle of its narrowest part, presents no such engineering difficulties as were encountered by the artificers of the Central and Canadian Pacific railways. With the latter system the line would connect by way of Alaska, for the most part across a level plain, and on the Siberian side would skirt the base of the Stanavoi

mountains, avoiding the tundras or marshes between them and the sea. To Vladivostok, on the sea of Japan, Russia's principal naval station on the Pacific, a railroad is already nearing completion, and such a route, if operated only for a few months in the year, would open for settlement or industrial purposes a vast extent of unoccupied territory, much of it rich in resources.



COWBOY IN FRONT OF BUILDING. PROCTOR

Of all the Exposition buildings this is the only one whose exterior has been treated with color decorations. Beginning at the base with a light, delicate red, the polychrome treatment culminates in the golden doorway and the spandrels of the arches, in the centre of which are winged female figures, typical of transportation methods. This portion of the design is executed with singular delicacy of technique, the hues interblending in thirty different shades, and yet with such harmony that the entire effect is that of a single painting. On the northern side is a line of statuary representing great inventors; on the south, on either side of the doorway, are statues of Stevenson, Watt, Vanderbilt, and others, with figures emblematic of land and water transportation, and on the east are other symbolical groups.

The interior resembles somewhat an ancient basilica, the general plan partaking of the Romanesque, though with features suggestive of the French school as represented in the Ecole des Beaux Arts. But whatever their motif, the artificers of the Transportation hall, by whom

were also designed the Auditorium and other prominent buildings recently erected in Chicago, have here adopted a style

of treatment at once simple, chaste, and refined.

At right angles to the main interior façades are lines of rails, separated by passage-ways, and so spaced that two pairs give to each of the bays a width of thirty-two feet. This, says one of the Exposition architects, "became the module of dimension and the common divisor of the plan, forming the basis of the whole architectural scheme." In the annex, a plain one story building, are also railroad tracks, perpendicular to the

and Liberal Arts, is the point of architectural emphasis, "the golden doorway," enclosed by a fretted arch or series of arches resplendent with gilding, and with a chaste embroidery of bas-reliefs and arabesques. Around this portal are symbolic groups representing ancient modes of transportation as contrasted with the luxuries of modern travel. On either side are balconies and terraces, the latter with small kiosks, somewhat in the Mogul style of architecture. The expanse of frontage is further relieved by smaller doorways on either side of the more spacious entrance, and by allegorical figures representing the purposes of the building. At the ends are still other doorways, with several openings from the rear façade, the former with projecting pavilions richly decorated and flanked as in front by terraces. The roof, which is in three sections, the central one rising above the others, and with walls so pierced as to form an arcaded clear story, is surmounted by a cupola 160 feet in height, and surrounded by balconies to which, as also to the galleries, visitors are conveyed by swift-running elevators from the ground floor. From the higher balconies is viewed to the best advantage the city of the Fair.



GROUP BY BOYLE



A SECTION OF FRIEZE

transfer table, by the use of which the heaviest of rolling stock was readily placed in position. Along the central nave and elsewhere are long lines of locomotives, burnished to an almost painful degree of brightness. Add to this an endless array of other massive exhibits, to which an imposing vista of colonnades imparts a further emphasis, and we have in the hall of Transportation a spectacle which the visitor does not readily forget.

It was one of the purposes of this department to furnish, in a series of object lessons and with a wealth of detail such as was never before presented in written or illustrative form, a history of that science in all its details, such as carries the mind back from the year of 1893 to cycles long antedating the reign of the Pharaohs. Here, in its three main divisions of railways, vehicles, and vessels, are all known appliances for the conveyance of man, and that which man and nature have produced, with specimens or models of the machinery, and of all else whereby have been evolved the ancient and modern systems of locomotion and transportation. In the railroad groups are included mountain, spiral, and ship railways, with locomotives of every kind, from



SHOWING SECTIONS OF UNITED STATES VEHICLE AND BRITISH MARINE DIVISIONS

the one driven by George Stephenson to the hugest of steam leviathans. There are freight and passenger cars; drawing-room, parlor, and dining cars; officers' and private cars; mail, baggage, and express cars; working and construction cars; and if there be any other than these, then are they here on exposition. Here also are illustrated railroad construction, maintenance, equipment, operation, and management, with the history of railroads, exemplified by a collection of rolling-stock and relics, some of them more than half a century old. In the vehicles group are such as are or have been used on common roads, from an ancient war-chariot to a tally-ho coach, from a Chinese wheel-barrow to a brougham and victoria, and from the lumbering Indian bullock-cart to the sleigh and the swift-running bicycle. In the marine division are represented vessels of every form and size, from an African pirogue to an ocean-going steamer, with models of war-ships and war-boats selected from all the nations of the world.

Says the chief of the department, Willard A. Smith: "It is but moderate and fair to state that the railway division has never been approached in extent, variety, and general interest; that the vehicle division is a surprise even to the best informed, and that no previous marine exhibit of the many which have been held



VIEW FROM CENTRE GALLERY LOOKING NORTH

more than seventy-five carriages made by the most famous European builders. When this department was organized, no American, not immediately concerned in the work, believed it could be made other than purely American, and not a single country asked for space. Extremely discouraging was the reluctance with which two great foreign powers granted the privilege of reserving—not assigning—for each 15,000 square feet. Briefly, it may be said that the plans adopted have so won their way that more than one third of the entire space was awarded to foreign countries, with applications for additional areas, some of which we were compelled to refuse."

The railroad exhibits are the most prominent feature in the department of Transportation, including locomotives, cars, railroad trains, and railroad materials and supplies, contributed by many companies and by all the nations whose systems of intercommunication are most fully developed. Here is represented a branch of industry wherein is invested a capital of \$28,000,000,000, of which more than one third was supplied by the United States.

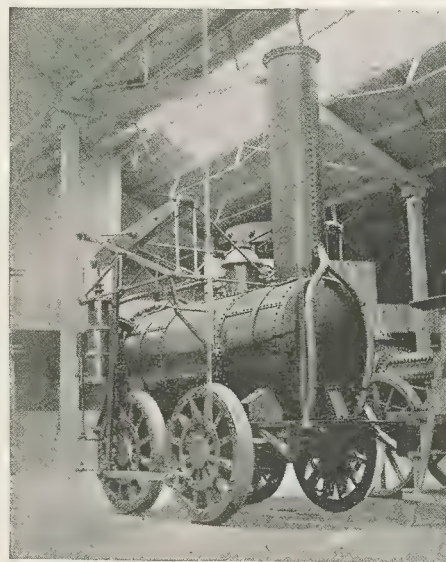
There is not enough money in the world, including its entire metallic and paper currency, to purchase one half of its railways, and the aggregate banking capital of all the nations forms but an insignificant amount as compared with that which has been sunk in railway enterprise. To civilized communities the railway is almost as necessary as is the circulation of blood to the individual, not only furnishing the means of locomotion, but bringing to our doors nearly everything we eat or drink or wear. Few there were who foresaw the marvellous events accomplished by railroad development, from the time when Stephenson drove his first locomotive at the rate of a dozen miles an hour, with a signal man riding in advance, until to-day, 60,000 locomotives speed at thrice that rate over 350,000 miles of track. And even in these closing years of the century, railroad enterprise is almost in its infancy, its benefits extending to less than one half of the habitable globe. In the entire continent of Africa there are less than 4,000 miles of road; in eastern and northern Asia there are less than 3,000, while South America and Australia have but a few thousand miles. Yet each of these regions could support a larger population than that of the United States, where a few of the leading corporations control a larger roadway and a heavier volume of traffic than all these countries combined.

In passing in review the railway exhibits of the United States, I will begin with that of our pioneer enterprise, the Baltimore and Ohio company, in whose elaborate display, almost in the centre of the annex, is a collection of the railways of the world, from those of most primitive pattern to the Royal

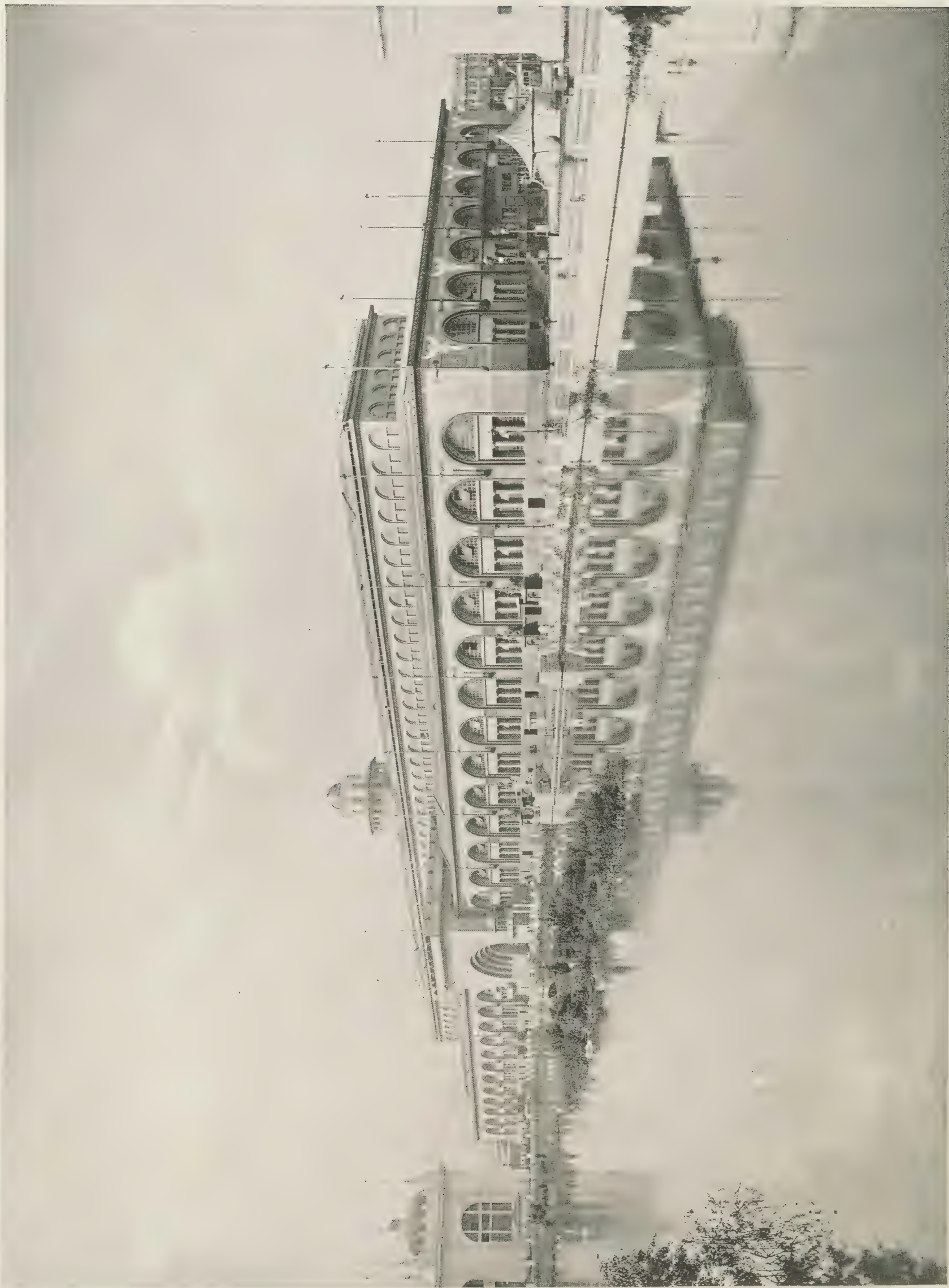
compares with this one in variety of detail and number of striking features. Two years ago it would certainly have been deemed improbable and even impossible, that we should secure from Europe a number of locomotives and cars, besides a large amount of railroad material and machinery, in view of the fact that there is no market in this country for such things. Almost equally improbable was considered the assembling here in an inland city of models of the world's navies, and of



STOURBRIDGE LION, BALTIMORE AND OHIO HISTORICAL EXHIBIT



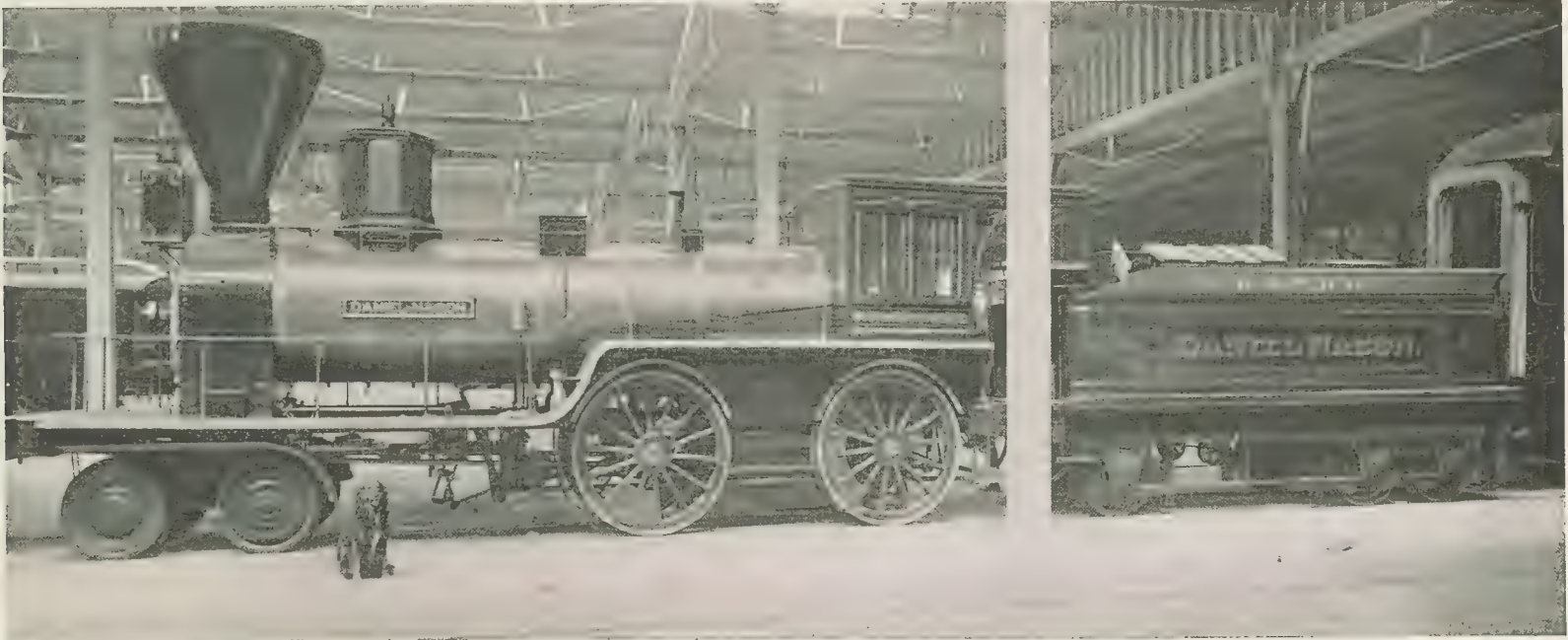
MODEL OF HUDSON VALLEY COAL ENGINE



TRANSPORTATION BUILDING FROM THE WOODED ISLAND

Blue Line express now running between New York and Washington. First, however, it may be of interest to sketch briefly the history and condition of our railroad systems, with their 175,000 miles of track, or more than one half the total mileage of the world.

In 1827 was laid the first rough track between Quincy and Boston, for hauling granite by horse-power for the Bunker hill monument. A year or two later a locomotive resembling that which Stephenson built was shipped from England for experimental purposes. It weighed about five tons, and drew on a level road-bed near the town of Honesdale, Pennsylvania, a load of some 30 tons, at a maximum rate of 25 miles an hour, this being considered at the time a marvel of speed and power. Early in 1830 was opened the first section of



EXHIBITED BY THE BOSTON AND PROVIDENCE COMPANY

the Baltimore and Ohio railroad, with wooden rails fastened by bars of iron. It was not until the following year that sufficient cars were built for regular passenger travel, and in July of that year was published in a Baltimore journal the first railway time table issued in the United States. It read in part as follows: "A brigade of cars will leave the depot on Pratt St at 6 and 10 o'clock A.M., and at 3 and 4 o'clock P.M., and will leave the depot at Ellicott's Mills at 6 and 8½ A.M., and at 12½ and 6 P.M." Thus did the burghers of Baltimore journey in their brigades of cars, still drawn by horse-power; for not until 1833 were steam-engines placed on the road. Meanwhile, in October 1831, the first passenger train drawn by a locomotive ran between Albany and Schenectady on the Mohawk and Hudson line. The engine used was the *John Bull*, of historic fame, now occupying a place of honor among the exhibits of the Pennsylvania Railroad company.

As to the discomforts attending these primitive modes of travel, the following extract from *Gilpin's Cosmopolitan Railway* may serve as a description: "The cars were of the rudest construction, resembling at first the old-fashioned English stage-coach, and with none of the modern appliances. The seats were narrow, stiff-backed and uncushioned, and the roof of the car so low that in winter ventilation was impossible. At each end a stove warmed the poisonous atmosphere, and at night a single tallow candle gave forth a dim and flickering light. The springs were of the most primitive pattern, causing the vehicle to jolt and the sashes to rattle like those of a modern hotel coach, so that reading and conversation



PROCTOR'S INDIAN AND HORSE



GROUP ON BUILDING. BY BOYLE

a fac-simile of Sir Isaac Newton's steam carriage, fashioned in 1680 on principles suggested by Hero's æropilon, or steam ball, which latter invention bears date 130 B.C. Newton's apparatus consisted of a copper boiler mounted on a frame which rests on wheels, a pipe with plug valve pointing backward from the boiler, and with the operator seated in front, the reactionary force of the steam, generated by atmospheric resistance, being expected to furnish the motive power. Whether Sir Isaac's carriage could ever be induced to move, history recordeth not, and it can only be said that, if the one exhibited at the Fair is a faithful reproduction, it does not look as if it could.

Next is a model of a steam carriage, in which is partially reproduced Denis Papin's invention of 1690. The former was the contrivance of a French army officer, and was intended for military service. It was one of the most cumbersome contrivances that man could devise, its heavy frame mounted on three wheels, the huge kettle-shaped boiler suspended over the single forward wheel, with single-acting cylinders, steering, and other apparatus, the operator seated on a platform, guiding the machine by a double-ended lever connected by gearing with the frame-work of the driving wheel. Greatly to the annoyance of mankind and the terror of horse kind this unwieldy engine made its appearance in the streets of Paris about the year 1769, and was there re-

were not to be thought of. The dust was intolerable, and as there were neither spark arresters on the engine nor screens at the windows, the traveller emerged from his car smutted and begrimed as though he had passed the hours in a blacksmith's shop."

From a score of miles in 1830 the length of track in operation increased to nearly 30,000 miles in 1860. During the time of the civil war less than 3,000 miles were constructed; but in the seven years ending with 1872, the total mileage was almost doubled, and thenceforth rapidly increased until, as I have said, in 1892 there were 175,000 miles of road-bed. Of this about one third lies west of the Mississippi river, a region where in 1850 there was not a single mile of track. In the United States there is on an average a mile of railroad to every 500 inhabitants, while in Europe the average is a mile to every 2,000 inhabitants, the volume of traffic in proportion to population far exceeding that of European countries. The operations of the larger companies are on a colossal scale, some of them handling 40,000 or 50,000 tons of freight a day, and with a corresponding amount of passenger travel. The total of freightage is probably not less than 600,000,000 tons a year, and of passenger fares about 500,000,000, from which the gross earnings may be estimated at \$1,100,000,000, and the net earnings at nearly one third of that amount.

In the exhibit of the Baltimore and Ohio company, occupying nearly an acre of floor space, is an almost complete illustration of railroad development, both as to engines and cars, the former arranged as models or originals of locomotives that have become historic. The collection begins with



STATION FOR ELECTRIC LAUNCHES

garded as a public nuisance, until one day turning a corner near the Madeleine it came to the ground with a crash, was seized by the authorities, and is now one of the curiosities in the Conservatoire des Arts et Metiers.

Even more ponderous was the engine constructed in 1784 by William Murdock, an engineer employed by the firm of Bolton and Watt. Its boiler rested on a frame in rear of the driving axles, the flue passing through it, the fire box beneath, and the cylinder above, the valve being worked by the walking beam. Of this there is a reproduction on a larger scale in the Baltimore and Ohio collection; but for what purpose it was built, except to demonstrate the possibility of running carriages by steam, does not appear. Certain it is that it could not be intended for practical use.

Three of the Trevithick engines are reproduced, one of them being actually used about the year 1808 as a locomotive; and with it are sections of rails, short, rusty pieces of iron, and the stone ties which preceded those of wood. Then comes the steam dredge which Oliver Evans constructed a few years earlier near Philadelphia. Passing by other models, among them a Blenkinsop engine provided with a cog wheel, the famous *Puffing Billy*, and the first one patented in the United States, we come to Stephenson's *Rocket*, which has been a thousand times described. Not far away is the *Stourbridge Lion*, built in 1829, and the first used in the United States for locomotive purposes. This is of the grasshopper type, of which there are many specimens in the collection, all somewhat resembling a primitive fire-engine mounted on a flat car. In models or originals are many engines which have done good service in their time, among them the *Traveller*, the first freight engine of the Baltimore and Ohio road; the *Mazeppa*, the first with horizontal cylinders; the *Hercules*, the first with equalizing beams; the *Peppersauce*, the first to climb Mount Washington; and a Perkins engine built in 1863, and removed from active service to take its place in Transportation hall. All the improvements made within the last three score of years are included in this exhibit, which ends with a Royal Blue express



PALACE SLEEPING CAR



SPECIMEN OF PARLOR CAR

train, at the head of which is one of the most powerful of compound engines, manufactured at the Baldwin Locomotive works. Here are shown progressively and in detail the various stages of development, how the first horizontal boiler replaced the vertical boiler, and the engine whose steam passed upward through the smoke-stack superseded the clumsy device in which a blower was used to aid combustion. There is also a collection of rails, from such as were laid without flanges more than half a century ago to the modern rail of Bessemer steel. Finally is shown in photographic form the railway machinery used in every quarter of the world.

Adjoining the section occupied by the Baltimore and Ohio railroad is the main exhibit of the Pullman Palace Car company, in which the most attractive features are two complete exhibition trains, a limited and a day train. Both are of finished workmanship, representing in its highest form of development a purely American invention, one opening a new field of progress in which no tentative efforts had been made in other lands. And yet it may be said

that, like other valuable inventions, this was almost the result of an accident. Some thirty-five years ago, while travelling by night from Buffalo to Westfield, George M. Pullman lay awake, bethinking him how to convert the rude sleeping car then in use, into a comfortable dormitory on wheels. The idea grew upon him, and in due time he rented a workshop at Chicago, hired skilled mechanics, and applied himself in earnest to the task. The result was the car *Pioneer*, the first one built, and costing \$18,000, or more than four times as much as the best before constructed. Though at first encountering strong opposition, it gradually revolution-



OBSERVATION CAR

ized existing theories of construction, for nowhere else could be found such a combination of strength and beauty, with minute elaboration of devices for ease and comfort. From this small beginning was developed the Pullman enterprise, with property valued in 1893 at \$60,000,000, and with more than 2,500 sleeping, parlor, and dining cars, carrying 5,000,000 or 6,000,000 passengers a year over the 125,000 miles of railroad under contract with the company.

In all the Transportation department there is no more handsome exhibit than the Pullman Columbian exhibition trains almost in the centre of the annex. At the head of the limited train is one of the most powerful of compound engines, named *Columbus*, from the Baldwin Locomotive works at Philadelphia. First is the baggage and smoking car *Marchena*, with bath-room, barber's shop, writing-desk and library. Next is the dining-car *La Rabida*, finished in the finest of vermillion wood imported from Central America, with windows of stained glass in delicate hues, seats elaborately carved, and kitchen which is a model of cleanliness and condensation of space. There are the sleeping car *America* and the compartment sleeping car *Ferdinand*, both marvels of comfort and decorative skill, the latter finished in Pompeian red, and



SLEEPING ACCOMMODATIONS



FOR THE POSTAL SERVICE

satin wood, artistically carved and polished to a mirror-like brightness, each of its compartments a miniature boudoir, and with separate design and color scheme, as in ivory and gold, in olive green, in blue and satin wood, all with upholstery of silk brocade. The last is an observation car, named *Isabella*, a portion of which is furnished as a drawing-room, with large railed platform at its end. In this train it would almost seem that the perfection of comfort and convenience had been attained, many skilful devices, though small in themselves, contributing to the general effect. All the compartments are provided with toilet appliances, and with water, hot, cold, and iced. The electric lights are shaded with silken fringe; the entrance ways paved with mosaic, and vases placed on stands remain undisturbed by the motion of the train; so smoothly run these palace cars, the very embodiment of the luxury of modern travel.

In the second train is a mail car of novel pattern, its walls finished with white enamel, with mail boxes of cherry, and all the appliances of railroad postal service. Next is the passenger coach 1893, with the softest



DINING-CAR, VESTIBULE TRAIN

of high-backed cushioned seats, the parlor car *Maria*, with its sumptuous appointments completing the railroad exhibit. All the cars are equipped with the Pullman vestibule, forming a solid yet sinuous train, under a single roof, and allowing the traveller to pass in comfort as in his own home, from sitting to dining or sleeping room. Here for the first time is shown the application of the vestibule system to the entire width of the cars, by extending the sides and enclosing the ends, with an original and ingenious arrangement of entrance doors, and with trap doors above the steps, whereby is avoided the exposure to wind and weather on ordinary cars with open platforms and projecting hoods. A still more important advantage is that it affords practical immunity from danger to passengers even in case of violent collision.

An entirely new and conspicuous feature of these two trains, and one which attracted wide and favorable comment during the Exposition, is the application of the vestibule to locomotive tenders, making it impossible for either the tender or the car next to it to be elevated to a position where one would telescope

into the other. By its use the locomotive is made a factor of safety in resisting shocks due to collision; and the train is made solidly continuous, practically ensuring the mail clerks, baggage and express men, and engine men, as well as the passengers, from injury in case of collision.

In the Pullman group is also a set of standard six-wheel trucks, with street cars of various patterns, one



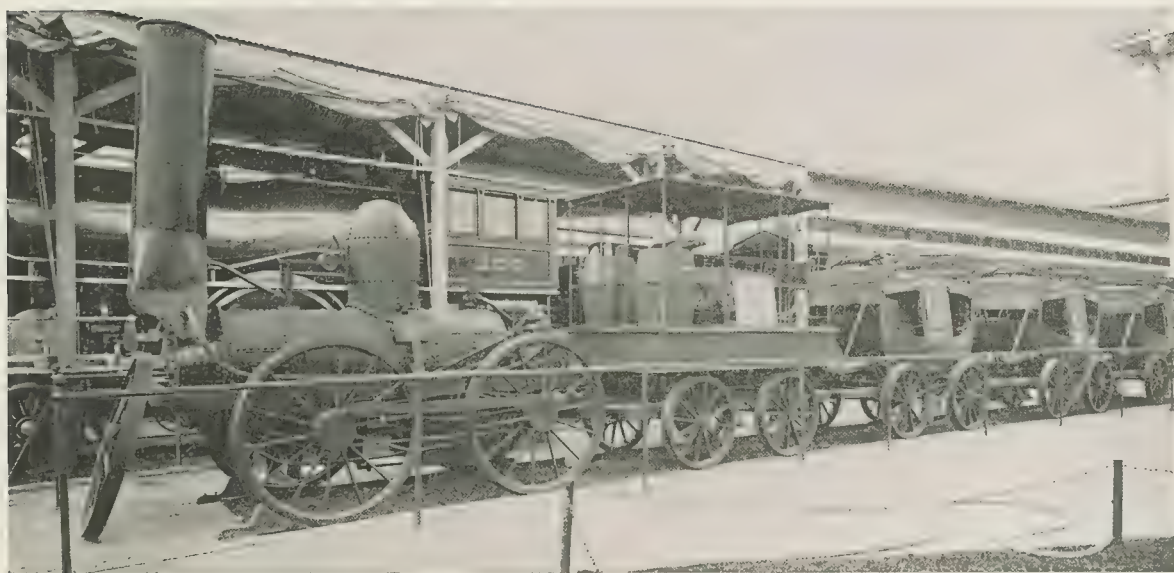
SMOKING CAR VESTIBULE TRAIN

of them an electric car with upper deck, such as are now in use at Washington. In the centre of the main building, fronting on the longitudinal nave, is a model of the workshops, stores, and dwellings of the town of Pullman, with its 12,000 inhabitants, more than half of whom are operatives actually employed at the works. Of these, further mention is made under the heading of World's Fair Miscellany.



DINING CAR, NEW YORK CENTRAL VESTIBULE TRAIN

South of the annex is the pavilion of the New York Central company, a separate edifice in the form of a triumphal arch connecting two side structures, one of them furnished as a waiting room, its walls hung with scenic paintings of landscape views from its lines of route, and the other serving as an office, where information is furnished as to the company's operations and exhibits. In the court between, with its flooring of mosaic, is a model of the Empire State express engine, 999, the original of which is stationed on tracks outside the building. For this locomotive, which is said to be the fastest in the world, such impossible rates of speed have been claimed as a mile in 32 seconds or 112 miles to the hour. The 999, built



LOCOMOTIVE "DE WITT CLINTON" AND TRAIN, PIONEER OF NEW YORK CENTRAL

for the occasion at the Schenectady Locomotive works, is an eight-wheel engine, long-limbed as a race-horse, with seven-foot driving-wheels, and of plain but handsome appearance. Beneath its huge boiler, with its heating surface of 1,700 square feet, there is room for a tall man to stand upright, while the diminutive smoke-stack is on a level with the curved roof which shelters the engineer. On the tender an inscription indicates the service for which it is destined, the engine and tender weighing together

more than 100 tons, and yet running as smoothly as a drawing room coach. The accompanying train consists of Wagner vestibuled cars, and includes drawing room, sleeping, dining, and smoking coaches, most of them decorated in Louis Quatorze style, with elaborate carvings and color scheme of gold, yellow, and pale green.

In contrast with this steam leviathan and its train of palace cars, stands at its side a reproduction of the *De Witt Clinton* locomotive, with its ramshackle cars, the former having fallen to pieces years ago, though some of the fragments were pieced together and the engine reconstructed from the original specifications. For the coaches the following is a portion of a contract, dated the 23d of April, 1831: "To the commissioners of the Mohawk and Hudson Railroad company, Sirs:—I propose and agree to furnish for said railroad company six coach tops, to be finished and hung in the style of workmanship generally adopted in Albany and Troy for post coaches; a baggage rack and a boot to be hung at each end; the length of coach body to be 7 feet and 4 inches, 5 feet wide in the centre and 3 feet 8 inches between the jacks; to have three inside seats, the back of the end seats to be stuffed with moss and all the seats to be stuffed with hair. The whole to be completed



NO. 999, THE GREAT ENGINE OF THE NEW YORK CENTRAL COMPANY



DRAWING ROOM CAR, NEW YORK CENTRAL COMPANY

as aforesaid for the sum of \$310 each. It is understood that the above coaches are not to be provided with lamps or mud leathers."

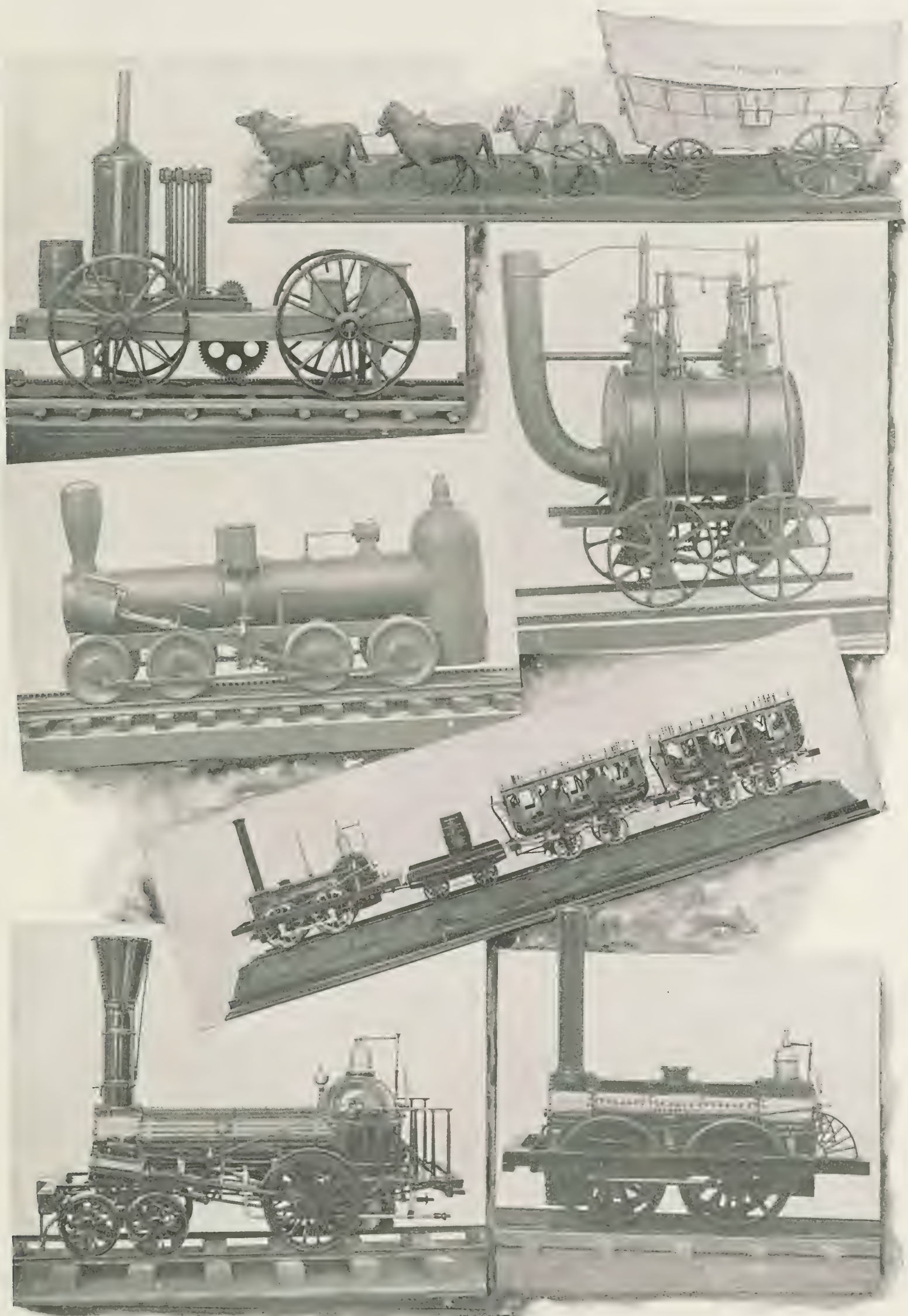
Here in truth we have the climax and anti-climax of railroad travel, in the palace cars of the Empire State express, costing perhaps \$30,000 apiece, and these primitive coaches of three score years ago, costing about one hundredth part of that sum, with their moss-stuffed seats, and without lamps or "mud leathers." As to the engine there is nothing whereunto we can liken it, unless it be to an old fashioned machine that has stood in the rain since the days of the colonial era. Its boiler is hump backed; its tender filled with water barrels, and its overgrown smoke-stack is without spark-arrester, cinders falling in showers on the passengers, who protected themselves with umbrellas, and at times used their coats to extinguish incipient fires. Thus did the good citizens of New York, including Erastus Corning, Governor Yates, and the high constable of the state,

travel on the pioneer trip from Albany to Schenectady on the 9th of August, 1831, the conductor seated in rear of the tender, and giving the signal to start by blowing a large tin horn. It may have been an interesting but it certainly was not a comfortable excursion; for we learn that the tops of the passengers' umbrellas were burned through, and that each one seized his neighbor's clothes to extinguish the brands that came from the pitch pine fuel, while, when a stop was made for water, the constant jerking caused by the slack of the cars was relieved by wedging rails between them and tying them fast with packing twine.

Near the pavilion of the New York Central, the Pennsylvania Railroad company erected a tasteful edifice of its own, in the form of a passenger station, behind which a track was laid with standard rails, and a signal tower and foot bridge overhead. Here also was displayed a historic and technical collection, but relating only to lines which have been associated with or merged in its system, showing in models, relief maps, relics, and illustrations in graphic



COACH OF "DE WITT CLINTON" TRAIN



PENNSYLVANIA RAILROAD COMPANY'S EXHIBIT

1. Conestoga, or emigrant wagon. 2. Model John Stevens locomotive, 1825, first in America. 3. Model Stockton and Darlington locomotive No. 1, brought from England to America in 1826. 4. Rack rail locomotive with cog gearing built for Madison and Indianapolis R. R. Co. 5. Locomotive "Lancaster," with stage cars; first steam train to run on Pennsylvania state railroad, 1834. 6. "George Washington," 1835: first locomotive to climb a heavy grade. 7. "Herald," Baltimore and Susquehanna railroad.

art, the results achieved by this organization, in which were consolidated, between 1846 and 1892 the interests of more than 200 corporations. At either side of the main entrance-way are depicted on panels in relief primitive and modern methods of travel and transportation for periods extending from 1492 to 1892. There are relief maps of termini and of the company's former and present lines, with relief models of Horse Shoe curve, and of cars, locomotives, and canal-boats. A perspective map, 33 feet long, shows the exact location of every train in its system at six o'clock in the evening of Columbus day, the 21st of October 1892. A chart explains some of the workings of the organization, and impressions from seals the gradual accretion of its corporate interests.

Among the models, most of them about one tenth of the actual size, are a stage coach that ran between Pittsburg and Philadelphia nearly 70 years ago, and a Conestoga wagon such as was used before the railroad



BUILDING OF PENNSYLVANIA RAILROAD COMPANY

era for eastward travel and transport to the Ohio and Mississippi valleys. Of locomotives there are among others models of the one which John Stevens built at Hoboken in 1825, and of the Stockton and Darlington engine *No. 1*, imported from England in 1826 by William Strickland, and loaned for the occasion by the Franklin institute of Philadelphia. There is the historic *John Bull*, its model made from the original drawings sent with the engine from Stephenson's works. After making the trip from New York to Chicago in somewhat less than a week, the engine itself with its two old-fashioned cars was installed in the yards at the terminal station near the Administration building, thus reproducing the first train drawn by a locomotive in New Jersey,



THE OLD "JOHN BULL" ENGINE AND TRAIN

the date being the 12th of November, 1831. There is also a rack-rail locomotive constructed for the Madison and Indianapolis railroad, near which are the *Herald*, which did service on the Baltimore and Susquehanna road in 1831, and the *George Washington*, built in 1835, the first to ascend a heavy grade.

Among the models of passenger and freight cars are two stage-body coaches, originally drawn by horse power, and which, with the engine *Lancaster*, formed the first train run on the Pennsylvania State railroad in 1834. There is one that plied in the same year between the business quarter of Philadelphia and the ferry across the Schuylkill river. To this date also belongs the first car with shingled gable roof, and with straight-backed seats, in which none but a quaker could sit. Of freight cars there is one which did service in 1836, and there is a baggage car built in 1849, the baggage being placed in wheeled crates and carried across ferries without removal.

Finally, there are the original cars, built specially for the purpose, by which the Krupp guns were hauled to Jackson park, with models of the guns upon them.

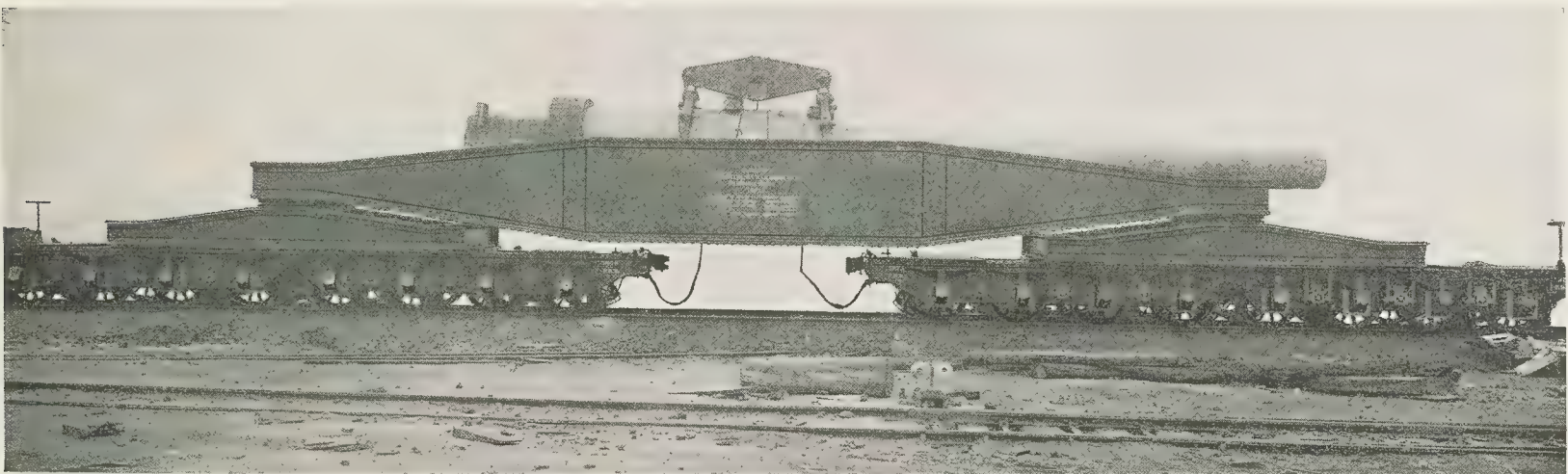
Safety appliances are shown, with train-signals, lanterns, and color-blind tests. There are lay figures of trainmen, conductors, brakemen, and other employes in uniform. There are models of tracks laid between 1831 and 1857.



MODELS OF "JOHN BULL" AND KRUPP GUN

There are tug-boats, a ferry boat, lighter, and barge, whose achievements date from 1839 to 1892. There is hoisting machinery by which a 3,000 ton vessel can be loaded in four hours, and there is a model of the first railroad bridge constructed in Pennsylvania, with spans of timber nearly 1,000 feet in length.

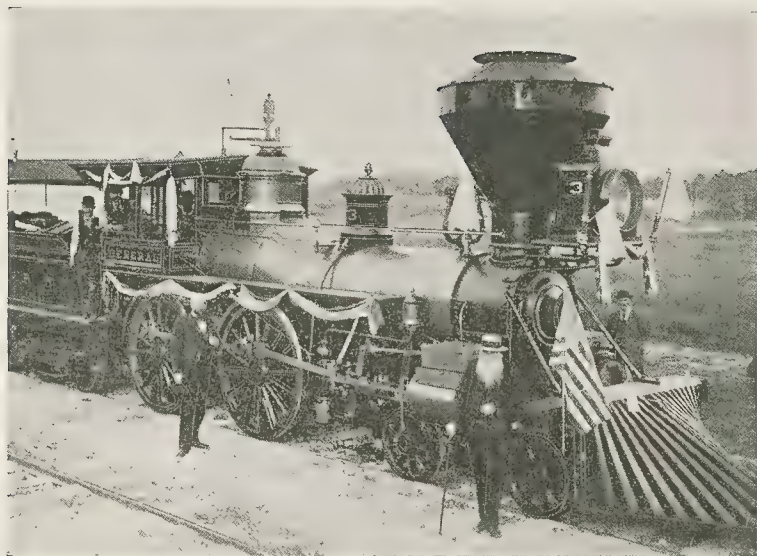
In cases and frames is a large museum of railroad relics and curiosities, including more than 1,000 specimens. Among them are rails and chairs laid in 1833; the whistle used by a driver on the old state road in 1832, when cars were run by horse-power; an old copper penny that helped to purchase the first ticket sold in the same year by the Camden and Amboy railroad; the ticket punch which a conductor used in 1849; a baggage check of similar date; a conductor's badge and tariff book of 1853, and the first guide book published by the Pennsylvania railroad in 1855. There are the wood-burning stoves used in passenger cars, the old fashioned signal lanterns, and the bells which for nearly half a century announced the arrival and departure of trains and steamers. Railroad literature is freely displayed, with reports, regulations, pamphlets, instructions,



CARS USED FOR TRANSPORTATION OF KRUPP GUN

pay-rolls, schedules, train-orders, way-bills, and advertisements, among the last a poster of 1792, advertising the "New Line Industry" by stage and sail boat from Paules Hook, now Jersey City, to Philadelphia. A so-called blank African ticket, issued in 1861, guarantees "that the person of color mentioned below is free, or is the slave of the party designated, and he has the permission of the said owner or owners to travel in the cars."

A collection of old views on Pennsylvania lines dates from 1832 to 1892. Among them is shown the wooden bridge built over the Schuylkill river in 1804, and used by vehicles, foot passengers, and later by railroads until its destruction by fire in 1875. On the Old Portage railroad is a train of freight cars being drawn up an incline by cable, behind it a "buck" or safety car, and at the summit an engine house and hitching shed. A stage coach is changing horses at a Pennsylvania tavern in 1825, and here again are *John Bull*, and the old

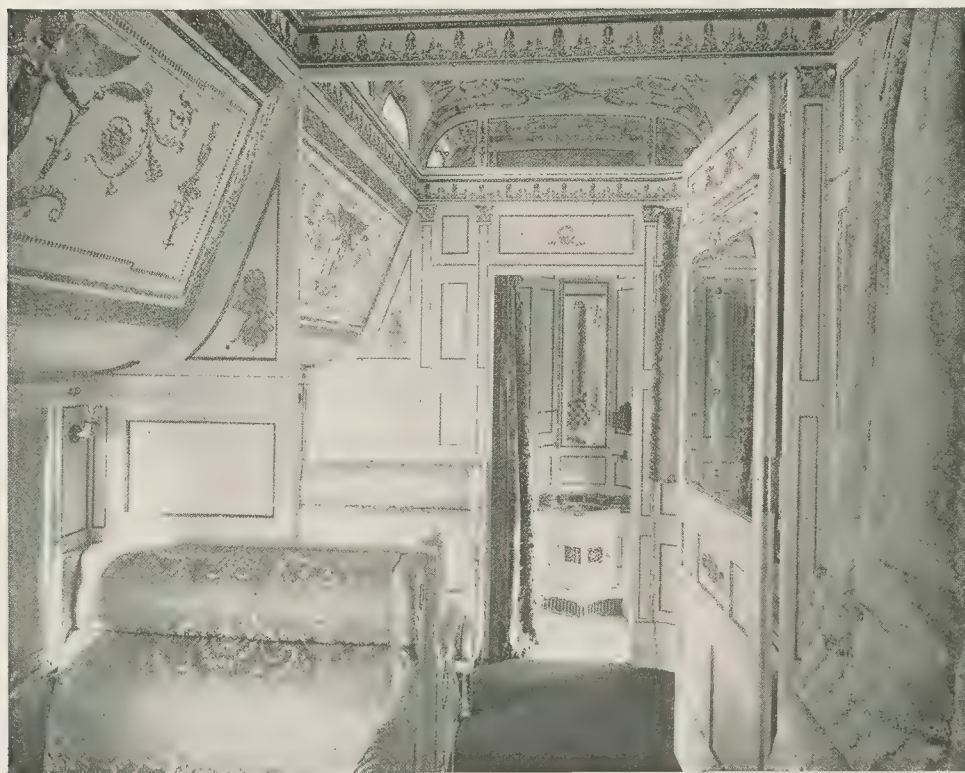


THE WAR ENGINE "GENERAL"

exhibits the first locomotive built for its line in 1858, and Providence, modelled after the stage coaches of the time, hung on braces, and resting on a four-wheel truck. In contrast with it is one of the last engines and passenger cars constructed for the company.

By other railroad companies historic engines have been placed on exposition, the Illinois Central for instance installing near the exhibit of the Pennsylvania company the *Mississippi*, built in England in 1836 for the Natchez and Mississippi line, now incorporated with its system. After doing service on several lines, in 1868 it was carried away by a flood, and after lying buried for ten years under a mass of débris was exhumed and repaired for further service. It is an odd-looking relic, and has been aptly compared to a boy's penknife which has several times been fitted with new blades and handle. On timbers beside it are specimens of the strap rails used on the Natchez and Hamburg line, on which this locomotive ran between 1836 and 1838.

Near the German section, in the north of the annex, the Chicago and North Western has on exhibition the *Pioneer*, so named as the first engine used on a Chicago road, one shipped by way of the lakes nearly half a century ago, when no railroad ran eastward from the



SLEEPING CAR IN WHITE AND GOLD

fashioned Conestoga wagons, with coaches, canal boats, and packets. There are locomotives of many patterns and dates, and the letters patent signed by Andrew Jackson and Martin Van Buren in 1831, granting exclusive rights for "a new and useful improvement in locomotive carriages and rails adapted thereto." The railroad riots at Pittsburgh in 1877 are depicted in graphic art, as also is the devastation wrought by the Johnstown flood in 1889. In drawings, photographs, and other forms are illustrated engineering work, construction, and maintenance, with bridges of iron, wood, and stone; stations, tunnels, cuts, canals, and floating equipment. In addition to this elaborate display the company occupies a small section in the annex of the Transportation building, where are passenger, refrigerator, and inspection cars of improved and recent pattern.

In an adjacent section the Old Colony railroad and a passenger coach that ran in 1835 between Boston



BUFFET AND LIBRARY NEW YORK CENTRAL TRAIN

midcontinent metropolis. Built in Philadelphia, in 1836, for the Utica and Schenectady line, a few years later it was purchased for the Galena and Chicago Union railway, then in course of construction. Here also is one of the quaintest of specimens, its smoke stack towering above the diminutive boiler and cylinders, with a single pair of driving wheels, and all its apparatus of most primitive pattern. Still another historic locomotive is the *General*, exhibited by the Nashville Chattanooga and St Louis railroad, by whose manager it was rescued from a limbo of refuse not far from the spot where it was captured by a band of confederate raiders in April 1862. Of this incident the story is briefly told under the heading of World's Fair Miscellany.

Of modern specimens displayed in the American sections of the Transportation department, aside from those already

mentioned, the largest collection is from the Baldwin Locomotive works at Philadelphia, consisting of fifteen engines adapted to all varieties of service, including broad and narrow gauge, simple expansion, and compound locomotives, with such as are used on mines and plantations. The Brooks Locomotive works of Dunkirk, the Schenectady and the Pittsburg works, are also well represented, the Schenectady works having one of the largest engines in the annex. The Cooke Locomotive and Machine company, of Paterson, New Jersey, sends a freight and a passenger engine; from Lima works in Ohio come a logging engine and car; the Rhode Island works at Providence, and the Rogers works at Paterson, New Jersey, have each three engines on exhibition, and from the Richmond works is a locomotive of finished workmanship. Finally, the H. K. Porter and company's works at Pittsburg show some of the smallest engines used for special purposes, but equipped with all modern appliances.

Among foreign participants Great Britain occupies a prominent section in the annex, facing that of the Baltimore and Ohio railroad. Though somewhat limited, the display is of historic as well as of practical interest,



PAVILION OF NEW YORK CENTRAL RAILROAD COMPANY

for England is the mother of railroads, and by her have been furnished, almost from Stephenson's days, the types for many European systems. Here one may study a full-sized model of the *Rocket*, which on a September day of 1825 dragged between Stockton and Darlington a heterogeneous procession of vehicles, from a hucksters' wagon to a family coach. As all the world knows, it was driven by the Scotch engineer who, beginning life as a cowherd and at eighteen unable to read or write, gave to the world an invention which revolutionized its commercial and industrial conditions. Though conveying passengers from Stockton to Darlington at the rate of one shilling a head, the line was mainly used for carrying minerals and merchandise, at once reducing the freight on the former by more than 70 per cent, and on the latter by 90 per cent. Such was a foretaste of the great work which railroads were destined to accomplish.

On the completion of the Liverpool and Manchester line in 1829, it became apparent that ere long a transformation would be wrought in methods of travel and transport. Others followed, slowly at first, and then in more rapid succession, so that before the middle of the century the foundation had been laid of all the great trunk lines interlacing the British isles. In 1853 there were nearly 8,000 miles in operation; in 1873 this

mileage had been doubled, and at the close of 1893 more than 20,000 miles were open, railroad construction having almost reached its limit as it would seem, for there were few more lines to build, or few that would pay to build. The entire capital invested in these enterprises is not far short of \$5,000,000,000, the gross revenue from which exceeds \$400,000,000, or at the rate of \$20,000 a mile, while in the United States, though with nearly thrice the total of earnings, the average is less than \$8,000 a mile.

A feature in British as compared with American railroads is their enormous cost, amounting with less than one eighth of the mileage to more than one half of the outlay incurred by the latter. This is due in part to the substantial character of English road-beds, but more to the expenditure for right of way, much of it passing through towns and cities, or thickly populated regions, and purchased at fabulous prices. The Metropolitan railway, for instance, built partially underground, cost at the rate of \$2,500,000 a mile, and the North London, constructed mainly on arches, \$1,635,000 a mile. Yet both these lines are paying properties, the latter requiring nearly 1,000 passenger coaches and several hundred freight cars for its dozen miles of track. In the United States railroads have been built within recent years at a cost of \$15,000 a mile, while for the most expensive sections of the Central Pacific, over and through the Sierra Nevada, the outlay was not more than \$150,000 a mile. Nevertheless, as an investment, British railways pay better than our own, averaging about five per cent on ordinary stock against less than two per cent in the United States. Another contrast is in the proportion of employés, with twenty men to each mile of British road against five in the United States. To the insufficiency of their working force is mainly due the large number of casualties on American lines, amounting to nearly 10,000 a year, more men being killed in 1893 than met their fate in the federal ranks during the three days' struggle at Gettysburg.

In the *Queen Empress* with its train of cars, exhibited by the London and North Western company, we have the most perfect types of rolling stock developed by British ingenuity. While there are larger and more

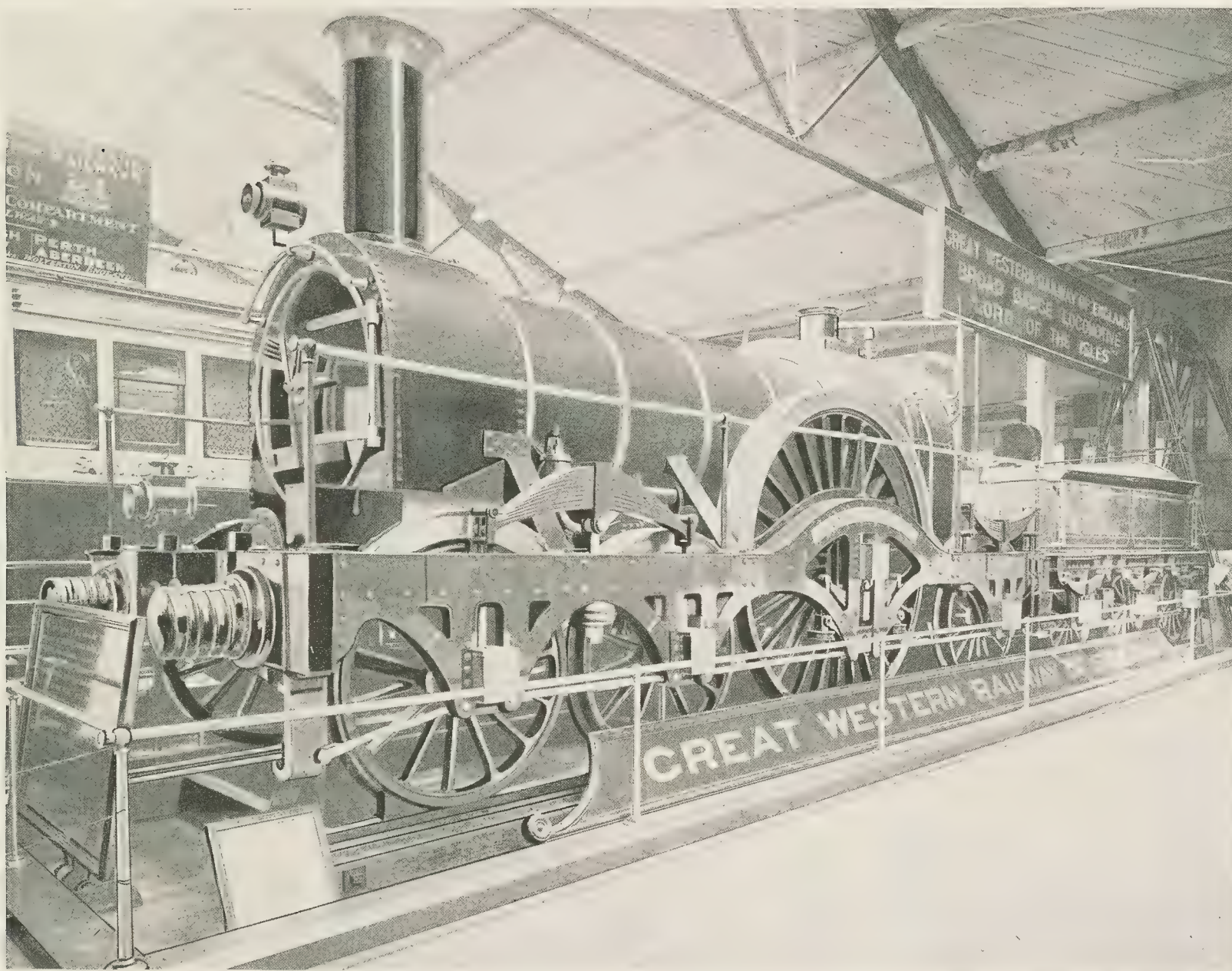


THE FAMOUS ENGLISH LOCOMOTIVE, "QUEEN EMPRESS"

powerful locomotives in the American section, there are none of more handsome appearance and more elaborate finish. Not only are the iron and steel polished to a mirror-like brightness, but the painted portions resemble the finest cabinet work, even the pipes of the smoke box being varnished, while the tube plate is of snowy whiteness. The engine itself is of a blue color, with stripes of red and edgings of green. Its weight is about 52 tons, and a novelty in its construction is that the high-pressure cylinders are placed in front of the forward driving wheels, with corresponding length of piston rods. There are more than 150 boiler tubes, with a total heating surface of some 1,350 square feet, and a steam pressure of 175 pounds to the inch.

The sleeping car contrasts somewhat sharply with those of American build, affording almost the privacy of a home, with broad, cushioned seat provided with arm rests and baggage rack for every passenger, the sleeping berths with wardrobes underneath, and each with separate lavatory and electric communication. In the centre of the car, and connected by a side aisle with either end, is a smoking room, finished in walnut and

satin wood, with easy chairs and folding tables. The composite car contains first, second, and third class compartments, the principal difference being as to finish, for all are well upholstered and comfortably furnished. Among other exhibits by the London and North Western are models, signal apparatus, and scenic views along



MAMMOTH LOCOMOTIVE OF THE GREAT WESTERN RAILWAY, ENGLAND

its line of route, the first including reproductions of the *Rocket*, and of a Trevithick engine, the first to run on a tramway between Merthyr and Cardiff, some ninety years ago.

The Great Western Railway company has on exhibition the *Lord of the Isles*, built for broad gauge lines, and partly to show their superiority over those of narrow gauge. This is a type of the first express engine ever constructed, others having been used for nearly half a century, and then retired only on account of a change in the standard gauge. From this company are specimens of the track used many years ago, one



THE CANADIAN PACIFIC ENGINE, "626"

of the rails weighing only 62 pounds to the yard, but laid on longitudinal sleepers and with continuous supports, enabling it to carry as much weight as the modern rail by which it was superseded, mainly because of the lower price of iron, and the higher cost of timber. There are also photographic views and portraits, among them

one of Brunel, the artificer of the *Great Eastern*, and in 1825 resident engineer of the Thames tunnel.

By the London firm of Westwood and Winby is exhibited the locomotive *James Toleman*, built for handling fast and heavy trains. In the mechanism of this engine there are special contrivances for combining speed and power, the driving wheels for instance having separate cylinders, with long piston rod for the transmission of power. The boiler is of unusual size, with a total heating surface, including fire box, of 2,000 square feet, and narrow enough in horizontal diameter to be placed between the driving wheels. The bearings are large, the connections strong, and the entire engine is a handsome specimen of workmanship, but with a complication of parts that must render difficult the task of keeping it in order. From Sir John Fowler and Sir Benjamin Baker are fine models of the bridge across the Forth, and from other companies are models and photographs of rolling stock, buildings, equipments, and the scenery along their lines of route.

Side by side with the exhibition train of the London and North Western is a full standard train of the Canadian Pacific railway, built at its works in Montreal, and showing the actual service of the company, with



GENERAL VIEW JACKSON PARK

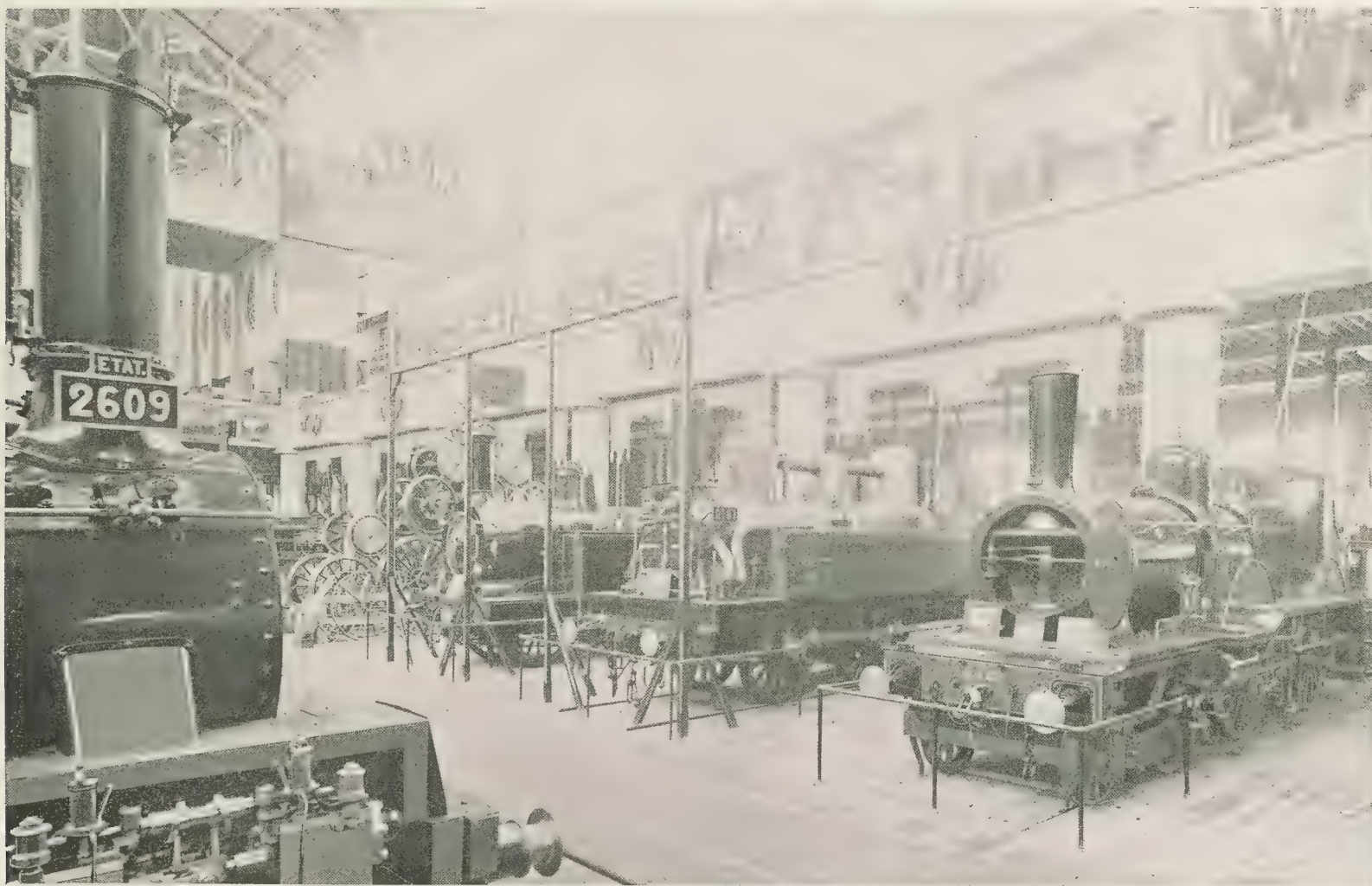
the accommodation furnished to passengers. At its head is a compound engine weighing 106 tons, with steel boiler carrying a pressure of 180 pounds to the inch. As with most of the steam leviathans housed in the annex, it is plainly finished, and of sombre hue, the tender painted black, with red facing and gold bordered panel. The baggage car is of the usual type adopted by the company, strong and solid, as are all the rest. Next to it is a second class sleeper, with leather covered seats arranged at night as berths as on the Pullman cars. Then comes a first class day coach, upholstered in wine-colored plush, and finished in Honduras mahogany, elaborately carved and with tasteful panellings. Arches resting on columns divide the car into sections without obstructing the view, and give to it a massive appearance. At either end is a smoking room, of which only the one in rear of the car is used when the train is running.

In the dining car, whose floor is heavily carpeted, are ten tables, with carved bronze alcoves, their seats covered with morocco leather, and with a rounded pillar at the back and end of each. The sideboard is an elaborate piece of furniture, rounded at the base, with plate glass panels, its handsomely carved octagonal top resting on massive columns. The last car is a first class sleeper, with ornate and elegant finish, its main body divided into eight sections, and at one end are state rooms with linings and curtains of richly flowered silk, connected with which is a toilet room with plate glass mirrors. The cars can be lighted either by gas or electricity, and are heated by steam from the engine. In maps is described the company's route around the world, and in graphic art is reproduced some of the finest scenery on this the most picturesque of American

railroad lines. From the bureau of public roads are also maps and photographs of road ways, bridges, and tunnels, and from private exhibitors collections of railway supplies.

Adjoining the British section on the northwest, New South Wales has condensed much that is of interest within a limited space. The hansom cabs, with their ingenious sliding doors, are specimens of excellent workmanship, and a collection of photographs gives the stranger to Australian enterprise a most favorable impression of the railway stations of Sydney, Albury, Newcastle, and other centres of the system, as well as of its bridges and rolling stock. A large model of the Zigzag railway shows the line winding around and climbing the sides of the Blue mountains, one of the remarkable engineering feats of modern times. Near by are models of the steamships *Austral* and *Glasgow*, and in the far end of the section are reproduced the Sutherland dry docks at Sydney, among the most extensive in the world. At the other side of the annex is a large pile of railway sleepers, made of iron bark wood, many of which have done service for nearly a quarter of a century.

Germany occupies a liberal space at the southern end of the annex, where are well represented the railway interests of the empire. The first of the German lines was completed in 1835, and of Prussian lines in

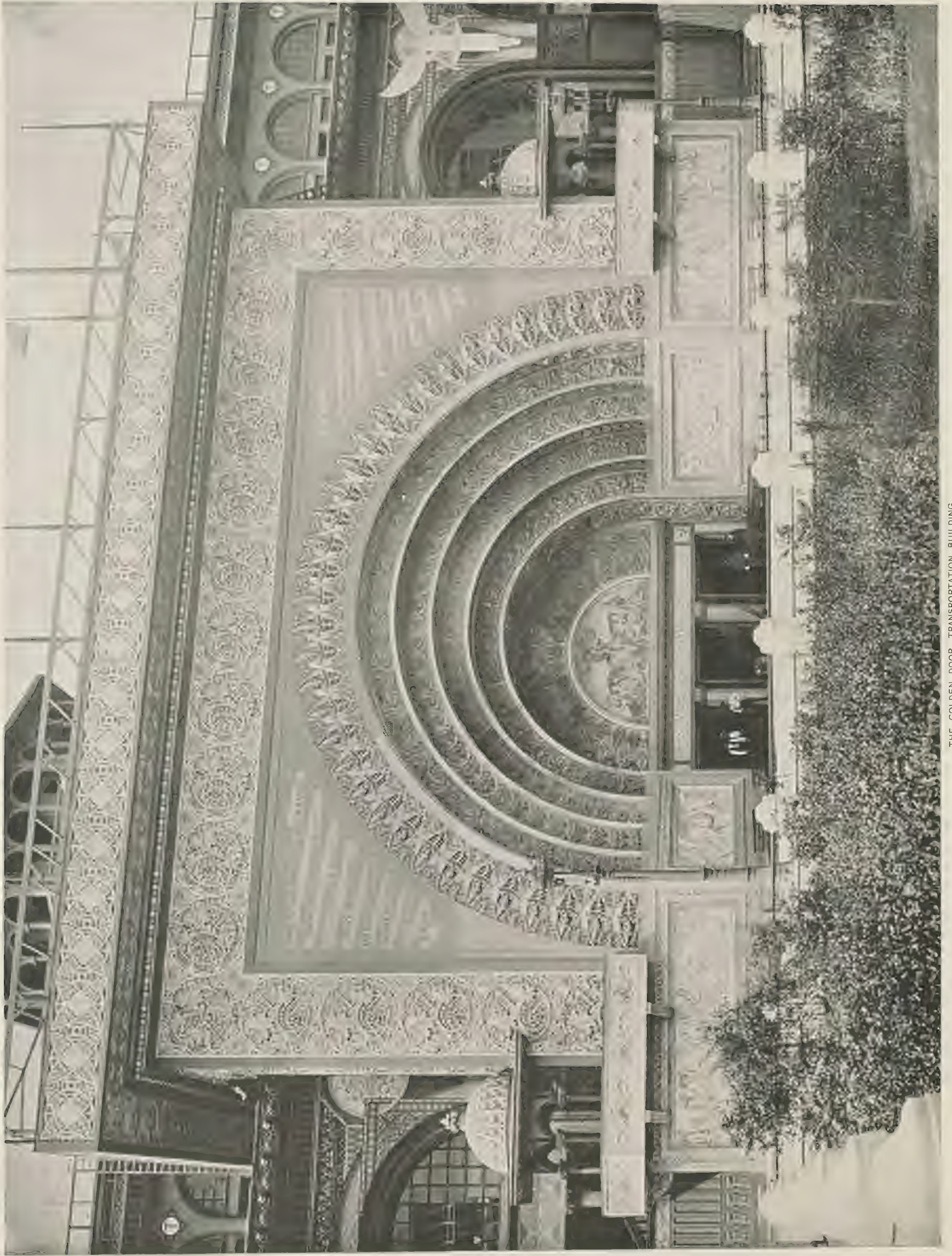


FRENCH AND BELGIAN LOCOMOTIVES

1839; but while the Prussian government encouraged railway development, and a decade later undertook the construction of railways of its own, it was not until recent years that her system was fully developed. In 1879 was authorized the purchase of private lines by the state, which in 1885 owned nearly all of the 14,000 miles of roadway. In 1892 there was double that mileage in operation, with 14,300 locomotives, 27,000 passenger, and 300,000 freight and baggage cars, the total earnings amounting to \$480,000,000, and the net earnings to 43 per cent of that sum; but in which, as in other countries, fixed charges as interest on bonds are not included.

First among the German exhibits may be mentioned that of the Royal Prussian state railway administration, at Berlin, consisting mainly of locomotives and passenger and freight cars manufactured in the principal railroad works of the empire. The first include a compound freight engine and tender from the Elbing shops of F. Schichau, and a locomotive with five-ton axle pressure from Henschel and son of Cassel. Among the rolling stock are three and four truck railway carriages, and a coal car with iron body, the last from a Cologne-Deutz firm.

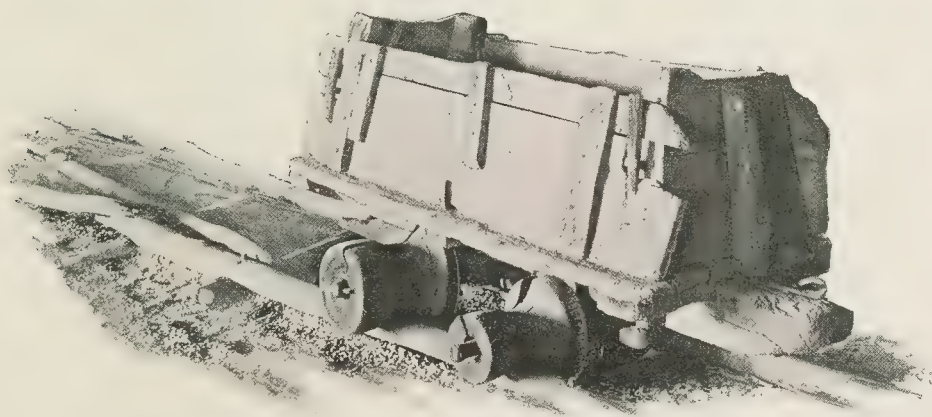
By Siemens and Halske of Berlin and Chicago are displayed all kinds of apparatus used for signalling, and for the operation and interlocking of railroad switches. Among them are two illustrations of their electro-manual system of block signalling, one adapted to German and the other to American lines, the principal features being the same in each, as with other apparatus, some of which has been in continuous service for many years. All the signals are controlled by the same instrument, and by an ingenious contrivance the electric circuit is connected with each of the rails, preventing the operator from unlocking the signal to the rear,



THE GOLDEN DOOR, TRANSPORTATION BUILDING

and thus avoiding a source of danger in manual block systems. And so with the track signal, which can be placed at any distance in advance of the signal tower, and has doubtless prevented many a collision. The same company exhibits an electric automatic system of block signals, and in Machinery hall has one of the most elaborate collections in the German department.

From the museum of Permanent Way, at Osnabrück, is a collection gathered from every quarter of the world, showing the roadways of many nations and periods, arranged chronologically and in groups. First is a specimen of the plank road named by Tacitus *Pontes longi*, laid by Domitius about the year five B.C., as a portion of a Roman military road across a swamp near Osnabrück, and excavated in 1892 from its dense overgrowth of moss. Next is a wooden tramway, such as is still used in remote and sparsely settled regions. Then there are exhibits of stone,



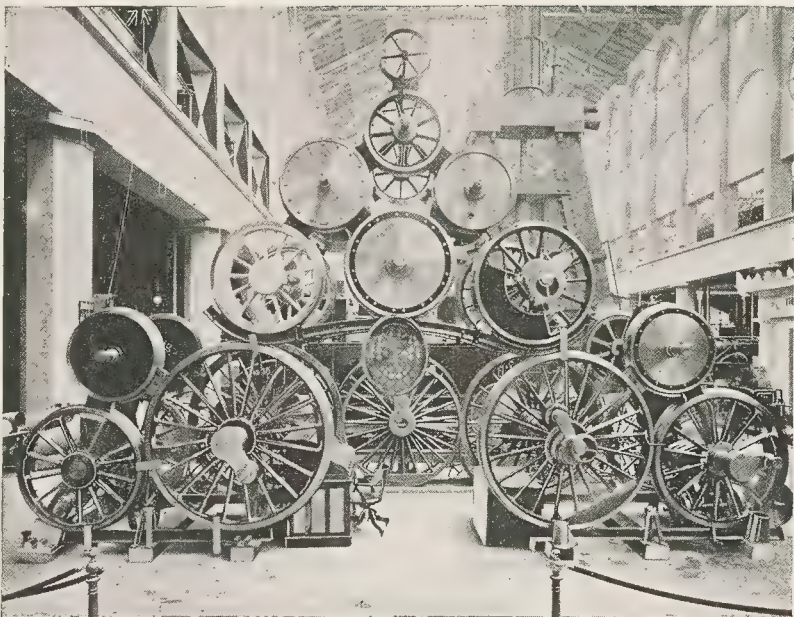
WOODEN TRAMWAY AND FIRST SWITCH. USED IN HUNGARY. FROM OSNABRÜCK MUSEUM, GERMANY

or reproductions, from the track on which Richard Trevithick experimented in 1804 to that which was laid in 1890 for Prussian state railways. There are self-bearing rails without sleepers and joltless permanent way of various kinds, operated at small expense, with other appliances for comfort and safety, illustrating many phases of construction both as to economy and technique.

In a superbly executed model is reproduced the railway station at Cologne, one of the finest specimens of railroad architecture in the world, 80 feet high, and with a central span of more than 200 feet. Near the northern portal of the Transportation building are sets of wheels for locomotives and cars, pressed castings and welded iron plates, with models of public and other works constructed by a Bergbau company, which, as it states, employs 7,600 men in the production of 250,000 tons a year of manufactured iron and steel.

In France railroad development has been largely aided by the state, which furnished one-half the cost of the earlier lines constructed, equipped, and worked by private enterprise. In the larger corporations were for the most part absorbed the local roads afterward built under government patronage, and in 1884 a contract was made with the six great companies for 7,000 miles of roadway in addition to the 17,000 miles then in operation, to be built at their own expense and the money ultimately refunded by the state, which meanwhile guaranteed a fair dividend to stockholders. These were not all completed, as it would seem, in 1891, when the total length of track was somewhat less than 20,000 miles. From all French railways the revenue for that year was stated at about \$230,000,000, of which nearly one half was net income; for in France railroads are managed with the closest economy.

In the French section, adjoining the main portal of Transportation hall, there are no such monster locomotives as are exhibited in the American and British departments. Of the four engines the average weight does not exceed 45 tons, and the average cost about \$15,000. Of rolling stock the only specimen is a neat, second class coach, used for local and suburban traffic, with seats across the body of



TROPHY OF FRENCH CAR WHEELS



CORNER OF MEXICAN CENTRAL RAILROAD PAVILION

the car and a stairway leading to the roof. The Northern and Western railways of France have special sections in which the extent of their systems is explained, as also their facilities for handling freight and passenger traffic. The latter has a model of the St Lazare station at Paris, showing the passenger depot, the long train sheds and freight houses, the depressed tracks, and the city streets which traverse the area partially occupied by the company's buildings and lines. Elsewhere a manufacturer of railway supplies advertises his wares in a monumental pile of axles tires and wheels.

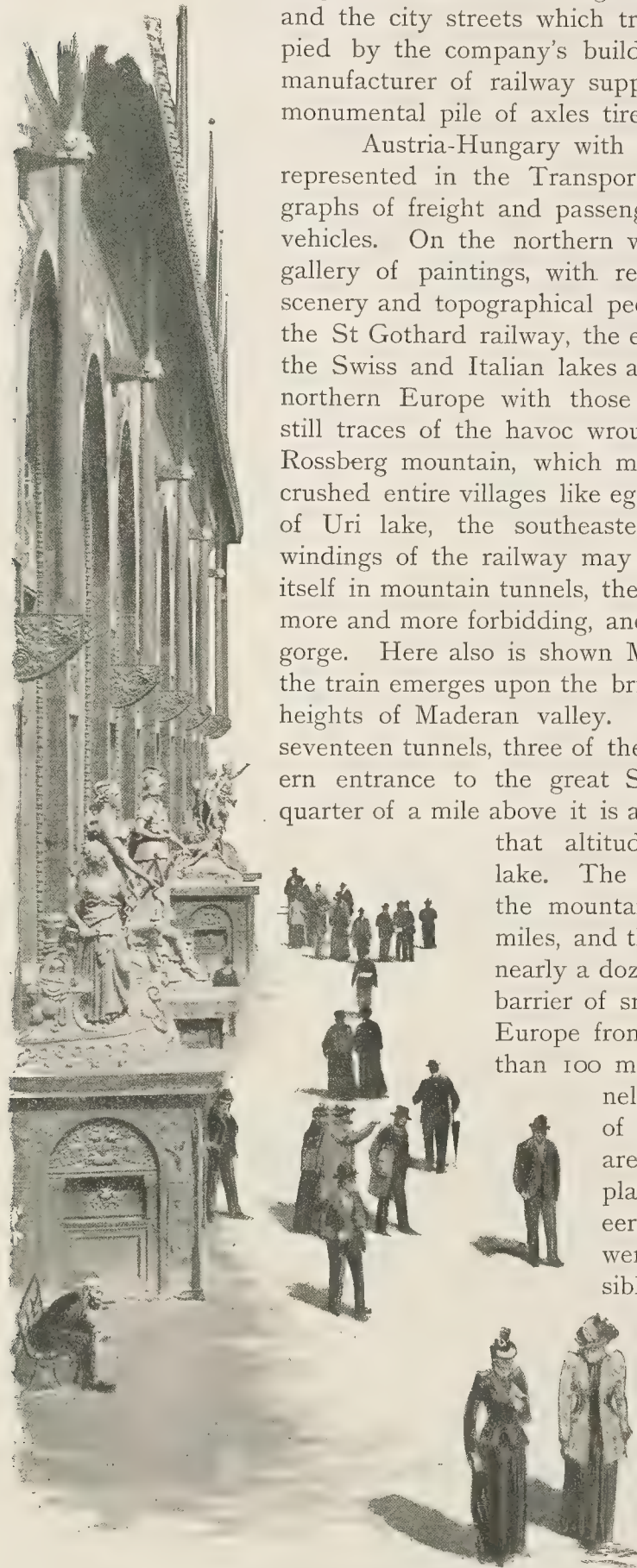
Austria-Hungary with her 17,000 miles of railroad is represented in the Transportation building only by photographs of freight and passenger cars, and a few exhibits of vehicles. On the northern walls of this building is a gallery of paintings, with relief maps illustrating the scenery and topographical peculiarities along the line of the St Gothard railway, the engineering link connecting the Swiss and Italian lakes and the railway systems of northern Europe with those of the south. Here are still traces of the havoc wrought by the landslide from Rossberg mountain, which more than eighty years ago crushed entire villages like egg shells. Along the shores of Uri lake, the southeasterly arm of Lucerne, the windings of the railway may be partially traced, losing itself in mountain tunnels, the rocks and peaks becoming more and more forbidding, and the valley narrowing to a gorge. Here also is shown Mount Bristen, from which the train emerges upon the bridge which spans the dizzy heights of Maderan valley. Then follows a series of seventeen tunnels, three of them circular, and the northern entrance to the great St Gothard is reached. A quarter of a mile above it is a little village, and at twice

that altitude, a miniature mountain lake. The main tunnel runs through the mountains for a distance of nine miles, and the entire railway, which for nearly a dozen years has traversed the barrier of snow peaks dividing central Europe from northern Italy, is more than 100 miles in length, the 56 tunnels covering about one third

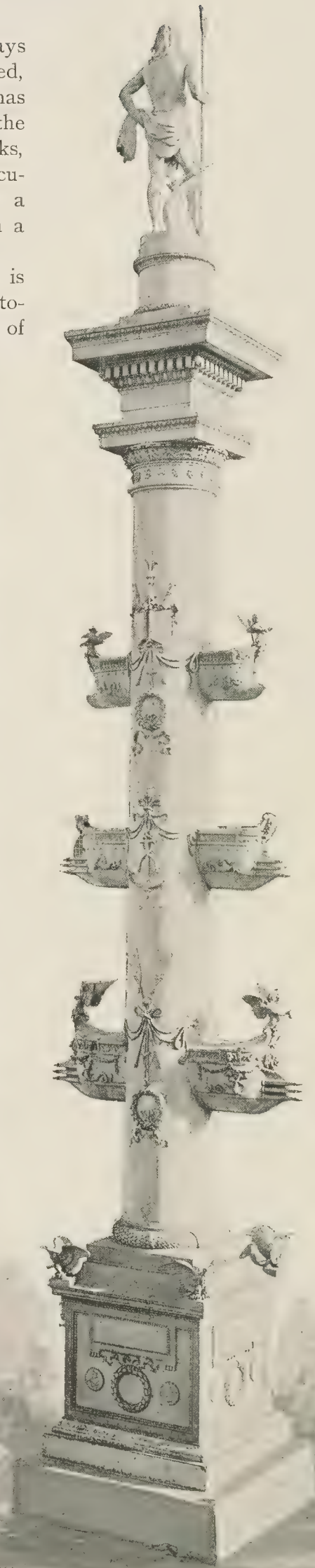
of the total distance. There are also illustrations of the plans adopted by the engineers, showing how valley levels were followed, wherever possible, in the construction of the great work. Models made by a professor of the Federal polytechnic at Zurich are works of art in themselves, the ideas of relative depression and

elevation being conveyed in gradations of color as well as in form, blue for the valleys, and orange for the hills and mountains.

Entering the Mexican section near the United States exhibit of vehicles, we are confronted with the typical horseman of our sister republic, with wide sombrero and mounted on a profusely caparisoned steed. Near by are specimens of saddlery and wagon



BESIDE AN OUTER WALL



ROSTRAL COLUMN, SURMOUNTED BY STATUE OF NEPTUNE

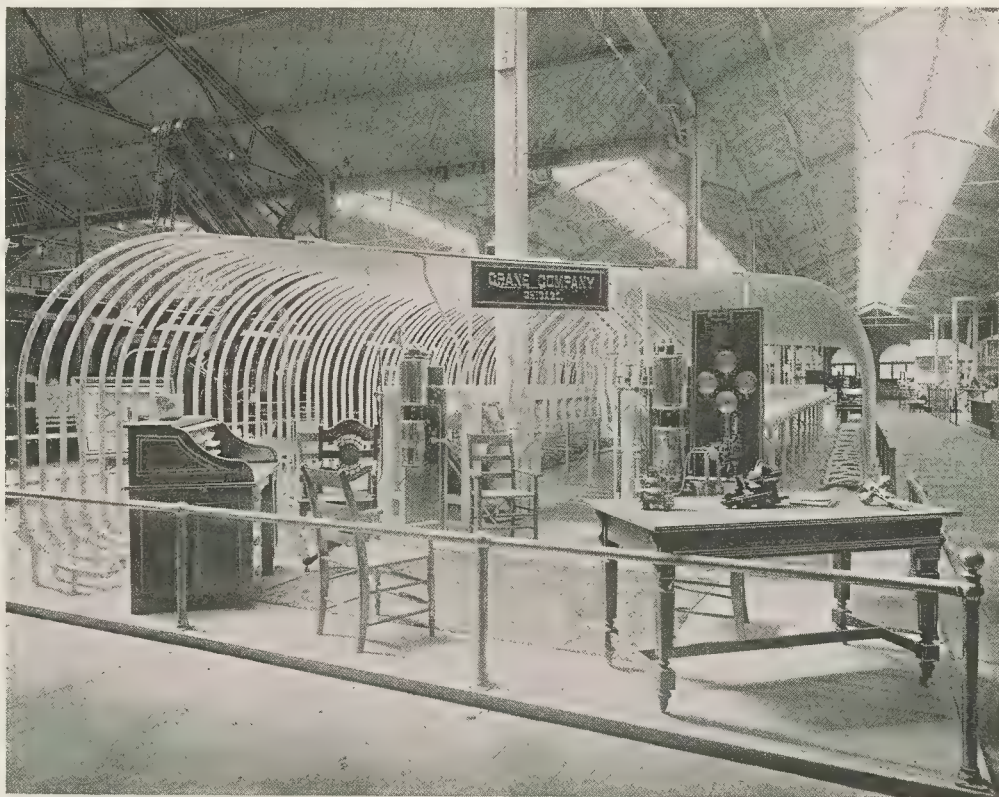
work, both of skilful execution. In one of the corners is a replica of the so-called stone sails near the summit of the hill of Guadalupe, in the neighborhood of which stands the temple of Our Lady of Guadalupe, whither, as the legend runs, a party of shipwrecked sailors, in fulfilment of a vow, bore the foremast of their ship,



EXHIBIT OF MODEL TICKET OFFICE

and other agents and agencies of transportation, with objects that have no connection therewith, as the kitchen of a peon's home, a convivial lover embracing his sweetheart, and a drunken husband arraigned before a Mexican justice.

Southeast of the central court is a large area in which our manufacturers display the multitude of articles classified as railway supplies, the range varying from such as are required for a passenger coach to the outfit of a railroad depot. From various establishments are such specialties as seats of wood, rattan, and metal for cars and stations, with folding beds, ceilings, panels, ornamental trimmings, and lighting apparatus. Of the two last there is a creditable display by the Adams and Westlake company, of Chicago, in a handsome pavilion whose decorations are mainly composed of the bronze, brass, and white metal trimmings now largely used for cars of elaborate workmanship. There is also a complete collection of headlights, signal lamps, and lanterns. Near by is the large model of the city of Pullman, mentioned in connection with the railroad exhibit of the Palace Car company, and adjoining this the publishing firm of Rand, McNally and company has a specimen ticket office, which is a bureau of information as well as an advertisement of the special classes of goods that the house supplies, as railway maps, tickets, punches, cases, and baggage checks. Upon the outer wall of this structure, which is shared with the Pullman company, is a large map of the United States, showing its complicated railway systems, and beside it the electrotype from which it was printed.



DISPLAY OF RAILWAY AIR BRAKES

In the section devoted to railway supplies, several bridge companies exhibit models and drawings of the structures which they have built, among them being a reproduction of the bridge thrown across the Mississippi

planting the transformed emblem of their devotion where now it stands. Of this curiosity there is an exact reproduction by the Mexican National railroad, except that it is some twenty feet lower than the original. The company's office is decorated with ancient pottery, casts of Mexican gods, and figures exhumed from the sculptured ruins of Aztec and Toltec civilizations. The Mexican Central has its headquarters in another corner of the section, and in a separate chamber, in the form of a miniature museum, shows in maps its lines of route. Along the walls are tiny painted figures of water-carriers,

river at the city of Memphis, the only one below the mouth of the Ohio river. Opposite is a finely constructed model of the bridge over the firth of Forth, the pride of British engineers. In the western gallery a prominent



THE PIONEER CABLE TRAIN

engineer traces in a series of drawings the evolution of the American bridge.

Under the group of railway supplies are classed the exhibits of air brakes of the many patterns now in use. The largest collection is that of the Westinghouse Air Brake company, which has a brilliantly lighted pavilion and a liberal space in which to display in working order its numerous specimens. It has also a train of cars, supplied with the latest apparatus, and furnished with compressed air pumped from Machinery hall, that the brakes may be seen in actual operation. Several companies have special apparatus for heating and lighting cars, the entire side of a long aisle in the annex being occupied with this class of exhibits. Two New York establishments make the most extensive showing, one of them illustrating

not only its specialties for heating by steam but what is known as the Pintsch method of lighting by gas.

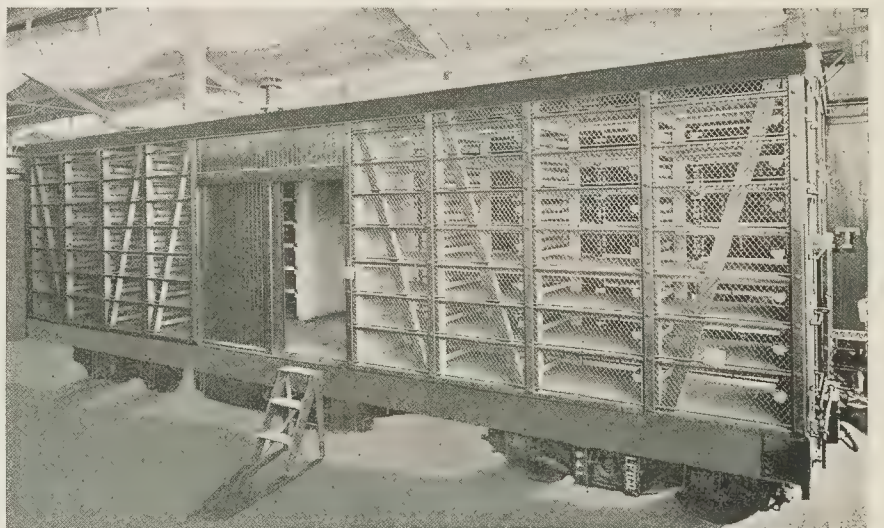
Among the miscellaneous features of the railroad exhibit there are few more attractive than that of snow ploughs. Of these there are several specimens within and outside the annex, the most noteworthy being the rotary snow plow used by the Atchison Topeka and Santa Fé company. It consists of a ponderous engine, with huge automatic reversible knives and hollow cone-shaped scoops; and one may well believe that the heaviest snow-drifts in the cañons of the Rocky mountains cannot long resist its onslaught. It has been thoroughly tested, and in a collection of photographs the plough is shown battling its way at various points through towering masses of snow.

Bicycle electric cars are among the new inventions exhibited in the railroad department. In some of them the wheel is so large as to protrude through the roof of the car; in others there is a smaller central and vertical wheel, with two which run horizontally upon side tracks.

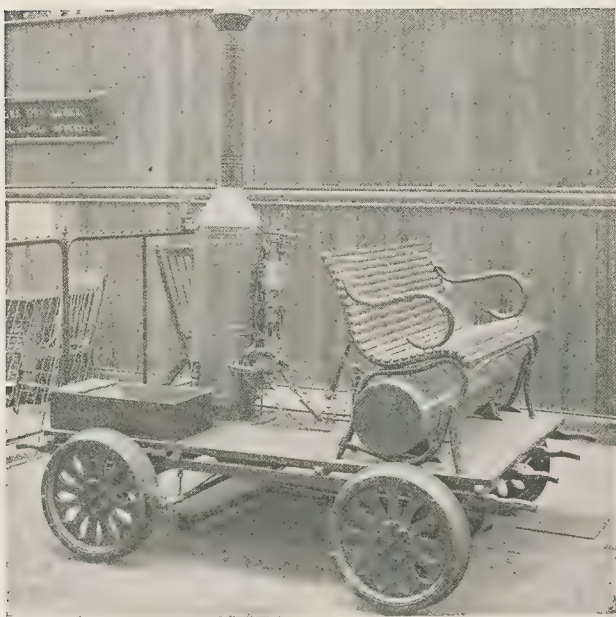
The efforts to avoid friction, both of atmosphere and rail, are illustrated by several mechanisms. One of the devices is a cigar-shaped car; and there are at least two electric railways over which it is proposed to run

trains suspended from the rails, rather than resting upon them. Through one of the contrivances it is claimed that a speed may safely be developed of 200 miles an hour, the central idea being the action of a bevelled drive wheel against a bevelled rail. On the top of the supporting trusses is a steel trough, sloping upward and outward from the centre, in which travel the truck and anti-friction wheels whence the car is suspended. The invention has been tested on a small scale, and even with imperfect roadway and electric motor it is said that a speed of over 40 miles an hour has been attained.

Although the exhibits of railroads proper completely dwarf those of the street car and minor lines, much is to be seen and learned by an examination of the latter groups; for here are displayed the latest patents in seats, stoves, wheels, switches, and all other appliances. Electric motors and the furnishings of electric cars are largely represented, together with all kinds of cable systems. In the latter direction San Francisco is prominent, A. S. Haliddie of that city, the inventor and builder of the first cable road, producing the original dummy used on a steep hill grade in August, 1873.



FOR TRANSPORTING LIVE POULTRY



AN INSPECTOR'S STEAM HAND CAR

In a section of the roadway are also revealed the workings of the grip and pulleys, and adjoining is a collection of grips used by various cable lines throughout the country, showing difference in style and mechanism. A California company, which manufactures wire cables, has a patent rope-way in operation, one devised for the transportation of ore over the mountains, and a Chicago establishment exhibits a motor operated by liquid ammonia supplied by stationary plants.

In the division of vehicles are included all the parts of which they are composed, and all appliances used for animals employed in travel and transportation, together with everything that tends to illustrate the development of this branch of locomotion from remote ages and from distant lands. First let us pass in review the collective exhibits



SPECIMEN CARRIAGE EXHIBIT



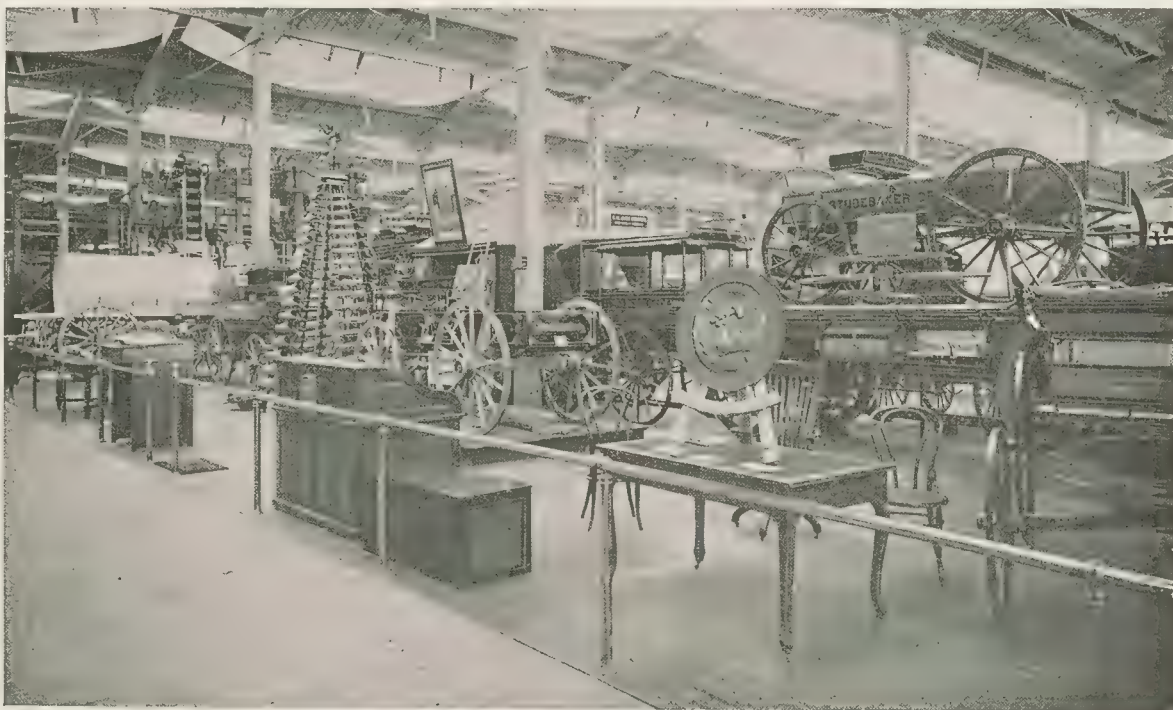
SAMPLE OF STREET SPRINKLER

for artistic design and finished workmanship. A so-called state hearse, made by the Crane and Breed manufacturing company, of Cincinnati, and covered with figures of cherubim and seraphim, was designed by a woman, and is valued at \$12,000. In another from the works of James Cunningham and son, of Rochester, is imitated the style of the Italian renaissance, with symmetrical dome, elaborately fashioned lamps, and body composed in part of bevelled glass, the highly polished portions relieved by those of more sombre finish. The same firm has also a

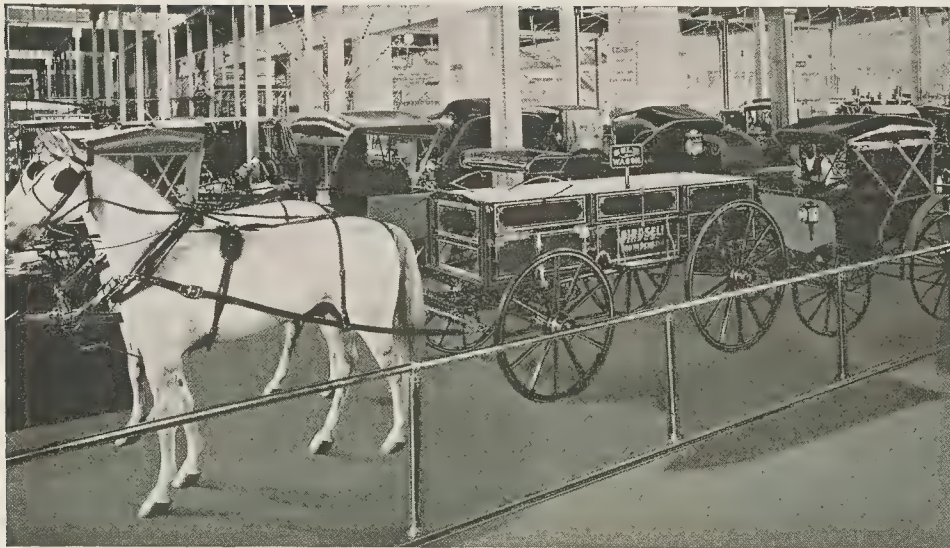
of the United States and Great Britain, with the historical specimens scattered among their sections, for here is the largest and choicest assortment of materials, far exceeding in interest those of other participating nations.

Nearly three acres of floor space in the northern portions of the main building and annex are occupied by vehicles exhibited by manufacturers in the United States. Generally speaking, light pleasure carriages, as pony carts, surreys, phaetons, rockaways, and coupés, with speeding wagons, sulkies, and trotting sleighs are found in the main hall, and in the annex are grouped the rougher and more cumbersome specimens, as trucks, farm and lumber wagons, street sprinklers, and such as are used by beer, coal, express, and ice companies. In the latter are also the delivery wagons of the grocer and dry-goods merchant, wheelbarrows, hand-carts, garbage and milk wagons, and various devices for dumping heavy loads.

In each of these sections, whose dividing lines are not distinctly drawn, are costly hearses, noticeable alike



VIEWS IN THE CARRIAGE AND WAGON SECTION



A WAGON COLORED IN GOLD

have an elaborate display, ranging from a light speeding wagon and a finely carved victoria to a massive four-in-hand. The Columbus Buggy company, of Ohio, also demonstrates the pleasing effects which may be produced by factory work, and adds to the interest of the entire exhibit by contributing to the museum of curios a typical Mexican ox-cart, its body and wheels made of huge timbers, and the state carriage of President Polk, built at Yorktown, New York, half a century ago.

A dozen or more of vehicles, of various nations and times, are ranged along the eastern and northern walls of the section now being described. First comes the Mexican litera, a kind of sedan chair, but with handles fastened to mules instead of to men, used for the conveyance of women over mountain roads. Next are the colonial carriage of 1760, and one of somewhat later date, used by a substantial citizen of Wilmington, Delaware, close to which is the pert, light sulky in which Nancy Hanks broke the world's record. In contrast with this feather-weight

vehicle is the four-in-hand drag which flanks it, made by a London factory for the prince of Wales. Beyond is an antique Vermont sleigh of the last century, and a quaint wagon, more than 100 years old, in which rode Nancy Standish Wells, of Wetherell, Connecticut, a descendant of Captain Miles Standish. Almost touching the latter are the handles of a Japanese jinrikisha, and not far away the lumbering ox-cart of Mexico, the family coach of President Polk—its cushions falling to pieces and its veneering much the worse for wear—and the more modern carriage of Daniel Webster. In this vicinity also is the Spanish volante, with its single pair of cumbersome wheels, the horses driven neither tandem nor abreast, but in a fashion between the two.

Passing into the annex, where again the Studebaker company is represented, we find a large collection of farmers' wagons, especially from Wisconsin, Illinois, and Kentucky factories.

Columbian coach, its body decorated in various colors, with trimmings of black, orange, satin, and gold lace. A New York manufacturer shows a sleigh in the form of a delicately tinted shell, resting upon a bed of sea-weed supported on the back of four dolphins. The front of the sleigh is in the form of a sea dragon, the coloring throughout being harmonious and artistic. Nearly a score of carriage manufacturers at Amesbury, Massachusetts, present a large and varied collective exhibit, including many styles of buggies, wagonettes, phaetons, and rockaways, with a remarkably handsome specimen of a tally-ho coach. Studebaker brothers, whose factory is in South Bend, Indiana, and their salesrooms in Chicago,



WAGONS FOR THE CITY DEPARTMENT



SPECIMEN PONY CART

Among other specimens of artistic workmanship is an ice wagon from a Philadelphia company, with historic scenes depicted on its panels, and a piano van from the same city, its body divided into diamond-shaped sections and painted in tasteful coloring.

On the ground floor is a small but choice display of British vehicles and their accessories, the main interest centring in the collections of two London firms. One of them has an assortment of drags, victorias, mail-phætons, a rustic cart, and a canoe-shaped landau. In the state-coach used by the lord mayors of London, the other firm presents an attractive exhibit, as is shown by the crowds which surrounded it. The gold-fringed hammer cloth, the golden lamps, the body of blue bearing the royal crest, and the interior furnishings of heavy, blue damask, with trimmings of blue and gold, give to it the gorgeous and fantastic appearance which helps to make the lord mayor's show the laughing-stock of the British metropolis.

Canada has but a slender exhibit of vehicles in her section north of the British display; yet one that includes nearly every description of conveyance used on land or stream, from heavy farm wagons to light carriages and phætons, with carriage springs and hardware, bicycles, skates, and sleighs in many styles. Of the last there is an interesting collection, as might be expected from a country where for three months in the year sleighs are almost the only means of travel and transportation. Among them is a model of the sleigh presented by the women of Canada to the duke of York and the princess May. It is a beautiful specimen of workmanship, showing the skill developed by long experience in this branch of manufacture. Here also are sportsmen's canoes, folding boats, snow-shoes, toboggans, and other special articles adapted to this home of the sportsman, with photographs of tourist routes and pleasure resorts.

In the French section the Parisian manufacturers who are mainly represented have organized an exhibit remarkable for its variety of form and bright, artistic

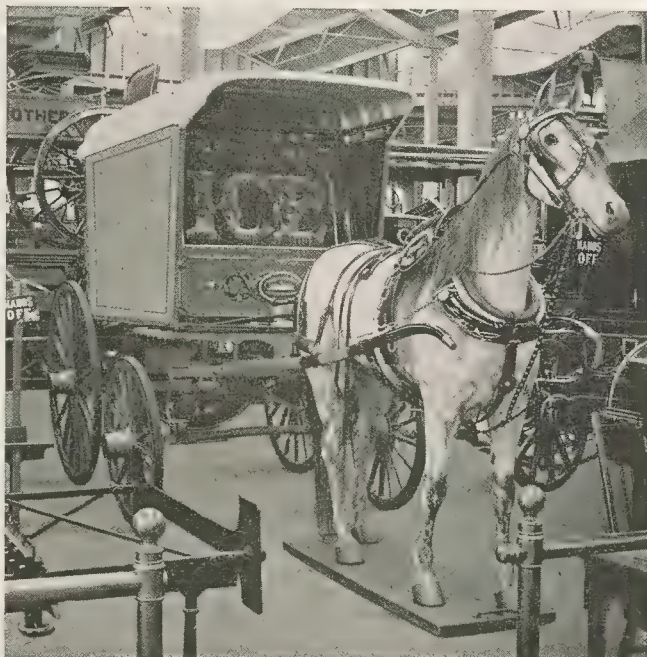


COLLARS OF ALL SIZES AND STYLES



COLUMBIAN MILK WAGON

coloring. A double-decked omnibus, with massive enamelled iron guards around the steps, seems to combine comfort with safety, and near it is a \$1,100 coupé of graceful outlines and richly but simply decorated, with an electrical indicator recording the distance travelled. Almost beside it is a gilded sedan chair of the seventeenth century, adorned with cupids, clusters of fruit, and garlands of flowers, while not far away are mail-phætons of unique design, landaus, dog-carts, road coaches, silver-mounted harness and saddles, with other paraphernalia, all tastefully arranged, a life-like dummy occasionally giving animation to the scene. There is also a small collection of bicycles, the remainder of the exhibit relating to the



LIGHT ICE WAGON



MONUMENT OF WAGON HUBS



MACHINERY HALL AS SEEN FROM THE OBELISK COURT

railroad systems of France already described in this chapter.

In the section devoted to vehicles Germany plays a modest part, her exhibit on the ground floor being confined to a small collection of bicycles and tricycles, a few carriages and wagons, registers for public cabs which record either time or distance travelled, and a carriage whose motive power is gas. Italy is but slightly represented in the Transportation department, her entire display consisting of a collection of cordage and whips, and a refrigerator car from a Milanese firm.

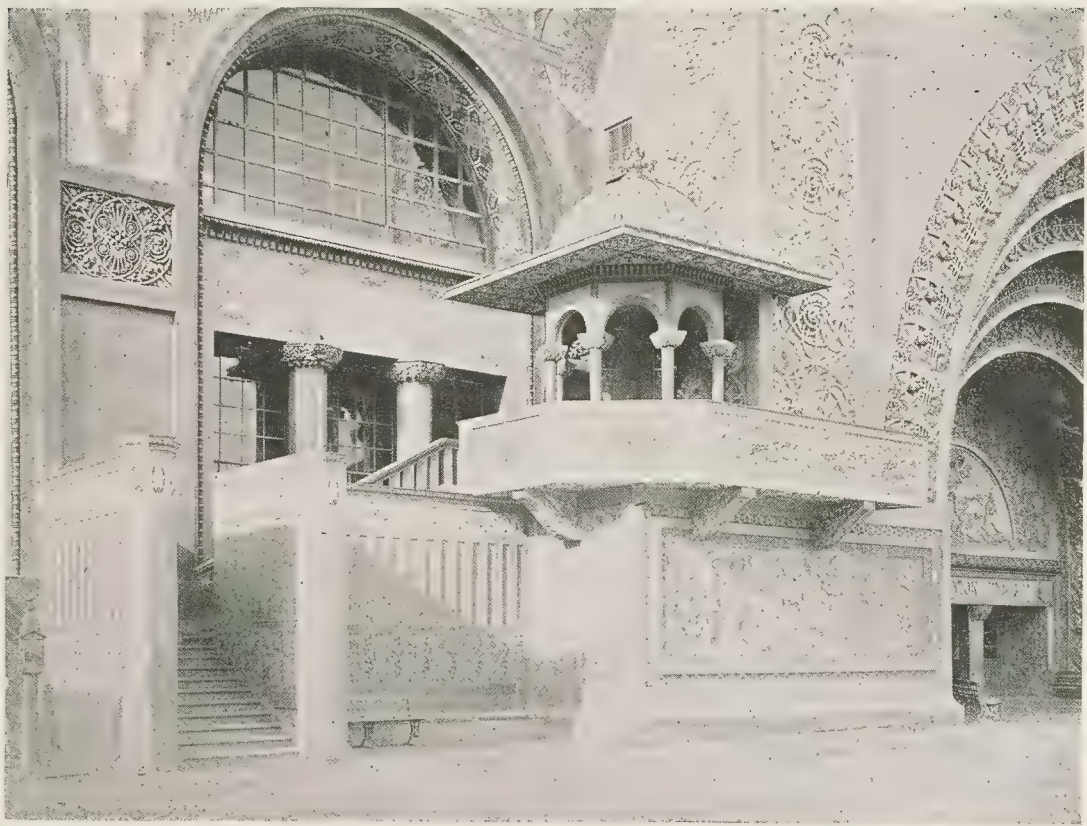
Droskies and sleighs of artistic design and elaborate finish, heavy robes, muffled outriders and drivers, are what the visitor expects to see in the Russian section; nor is he disappointed. Among the finest specimens is a large sleigh with rich ebony finish, the runners curving gracefully in front and the driver further protected from contact with his horses by a rampant figure of the king of beasts. This exhibit is by a Moscow firm, and another manufacturer from the same city displays the saddles and harness which have gained for him during the past forty years medals of bronze, silver and gold from the fairs of his own municipality and those of Philadelphia and New Orleans.

A structure of mediæval aspect now attracts the attention of the visitor, one that appears somewhat out of place in the Transportation building. Around it are patches of verdure, and a large mosaic of Columbus, set into the wall near the main entrance, adds to the incongruity of the exhibit. The Gothic arch which forms the doorway is approached by a short stair-case, and beyond, and within is the inscription, "The United Tyrolean Association for the attraction and guidance of tourists." This edifice is, in fact, a reproduction of a Tyrolean monastery of the middle ages, the figure of Columbus being the handiwork of native peasantry, who used in its construction pieces of opaque glass colored by burning. The alpine panorama presented to the visitor as he ascends the stairway is supposed to be viewed from the vestibule of the monastery. The canvas shows the grandeur of the Mittelberg glacier, and also the signs which direct the traveller to noted resorts scattered throughout that region.

Two small apartments at the side of the panorama further impart a religious aspect to the structure, containing as they do carved and painted figures of sacred personages, photographs of churches, and burnt etchings in wood in imitation of Raphael's work. Small alcoves are filled with articles made by the peasantry of the Tyrolean alps, including native costumes, and affording a gentle hint as to the real object of the exhibit are samples of the clothing best adapted to tourists whose path lies through these regions.

On one side of a screen in the Japanese section adjacent is a series of photographs depicting oriental modes of transportation. A leading rôle is played by the shah of Persia, with his state carriages and gorgeous

retinue. Opposite is a small space crowded with figures whose originals are found among the street carriers of Constantinople, this statement, however, not applying to the Turk, apparently bending double under the weight of a vast packing box consigned—so reads the custom house label—to the Columbian Exposition. The burdens



OUTER SECTION OF TRANSPORTATION BUILDING



CARRIAGE OF EX-PRESIDENT POLK



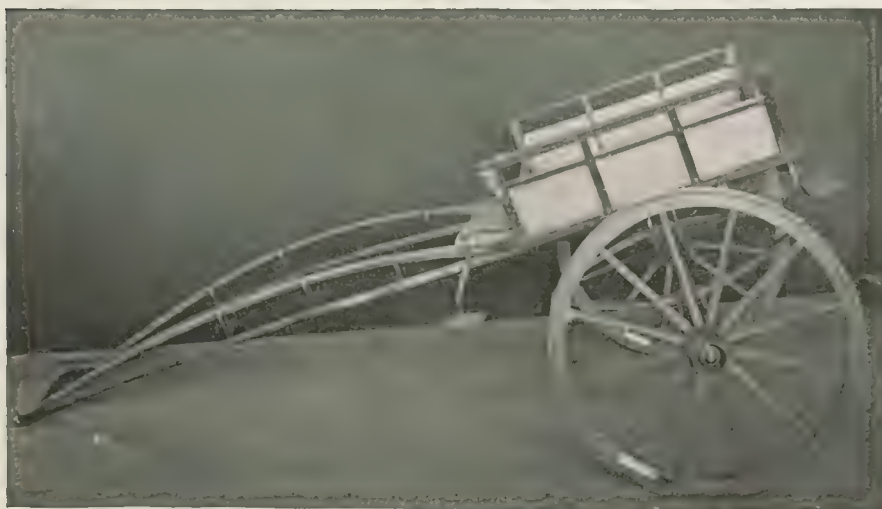
FISHERIES AND FOREIGN BUILDINGS FROM A DISTANCE



BIRDS-EYE VIEW OF GROUNDS

borne by the donkeys, the sedan carrier with his lady, the peddler with market basket on his back and tray of tins before him, and other typical characters, are more in keeping with the environment. Packs and harness for man and beast, with trappings and appliances of various kinds, are also within the scope of the exhibit.

In the Brazilian section, the old and new, the savage and civilized are strangely commingled, and the contrasts are rendered all the more striking from juxtaposition within a somewhat contracted area. Along one entire side is a canoe, more than fifty feet in length, fashioned from a large mahogany tree. A few feet away are a first-class passenger coach for local travel, and a roomy tramway car from Rio de Janeiro, with finely finished wood-work and reversible seats. Near an antique tricycle of the year 1850, the first one seen in Brazil, is the state carriage used by Dom Pedro in 1822. From the naval department of the republic are the great yards and docks at Rio, with models of engines, hoisting and other apparatus there employed. In a gaudy Turkish carriage, between the exhibits of Brazil and Mexico, is one of the many instances where the most diverse of civilizations touch elbows in the Columbian Exposition.

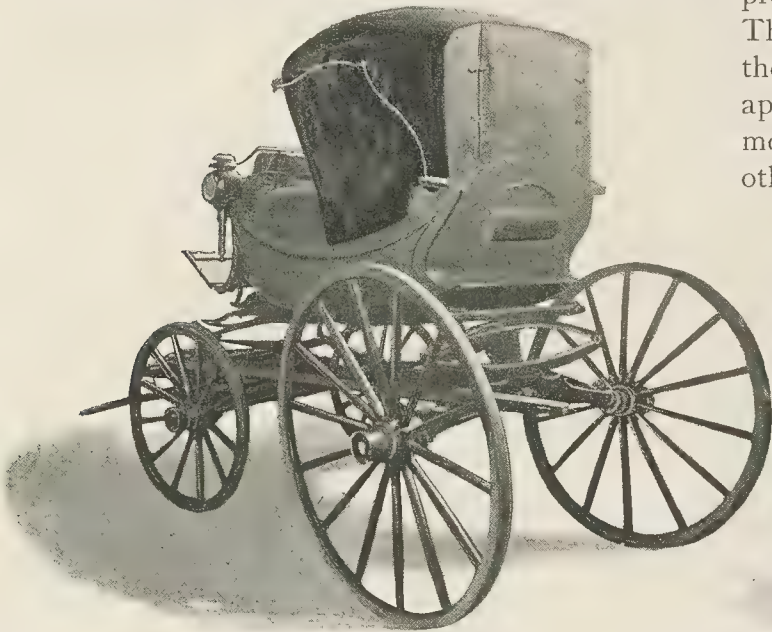


CART FROM SURAT, BOMBAY

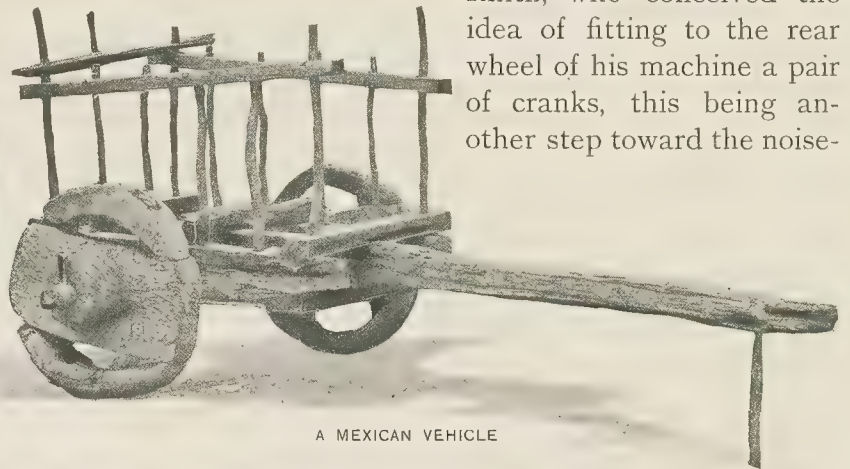
In the northern half of the gallery floor is a large assortment of bicycles and miscellaneous exhibits, and these I will describe beginning with the collection of Great Britain, which has here installed the greater part of an extensive display of vehicles. On a ledge of the gallery, in the midst of a museum of curios presently to be mentioned, stands an odd looking machine with wheels joined to a wooden backbone and handle. Upon it is a saddle, but the observer cannot detect the mechanism by which it was propelled, until in one of the quaint pictures which line

the walls he sees its counterpart. Astride of the latter is depicted, with his feet vigorously pawing the ground, the rider of the English hobby-horse, which, during its brief existence in the early portion of the present century, was mercilessly caricatured by the press. The specimen here presented is said to have been ridden by the first earl of Dunham in 1810. But aside from its comical appearance, this vehicle is of interest as the forerunner of the modern bicycle. Among those who mounted the dandy horse, otherwise called the pedestrian currie, was a Scotch black-

smith, who conceived the idea of fitting to the rear wheel of his machine a pair of cranks, this being another step toward the noise-

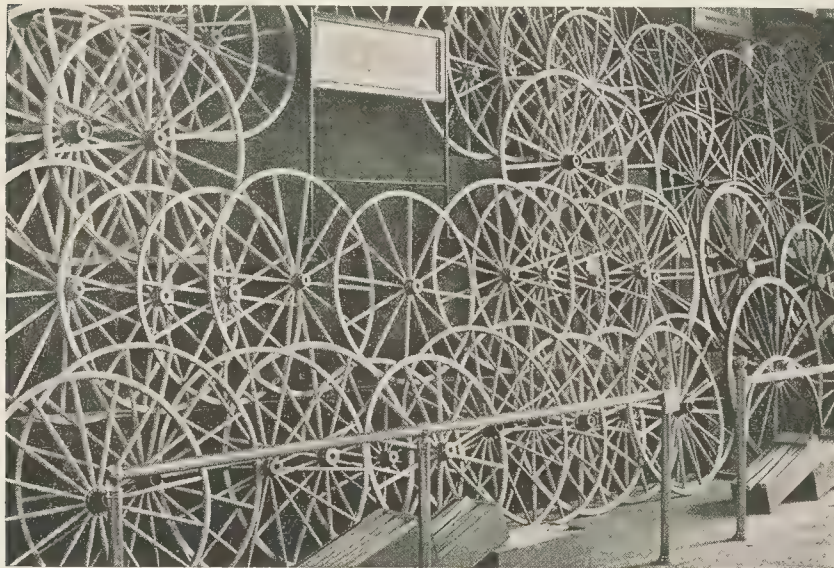


DANIEL WEBSTER'S COACH



A MEXICAN VEHICLE

less swift-moving machine of the present day. Tricycles and tandem bicycles it may here be observed, have never come into such general use as the trim, light, two-wheeled machine known as the safety—safe as compared with the high-wheeled pattern, and now furnished with pneumatic tires and trimmings of aluminium which help to reduce the weight.



AMERICAN CARRIAGE WHEELS

The British collection consists mainly of the bicycles best adapted to the excellent roads for which that country is famous. Here and there are a few tricycles, and several firms display such specialties as cold-drawn steel tubings, tires of peculiar make, and other parts of the machine; but as a rule the score of manufacturers who have organized this department confine themselves to the modern bicycle in its entirety. A Coventry firm has on exhibition more than thirty specimens of safeties alone, some weighing only 18 and none more than 30 pounds, the finer grades furnished with the twisted tubing which is only used in their construction. A Birmingham company has a large assortment installed in a richly furnished section, finished in mahogany with a neat office in the centre. Its standard machine weighs 37 pounds, the racer being only about half as heavy, and as one of its specialties is shown a bicycle for women. In the section containing a Nottingham made machine is a large case filled with medals, cups, and other prizes won by its rider, now generally recognized as the world's champion. The company also furnishes a record for 1892 of 100 notable races in which the machine and rider participated, the contests being held in Great Britain, Germany, Canada, and the United States.

On the southern wall adjacent to the French section, the institute of British Carriage Manufactures has an interesting collection of paintings, drawings, and engravings illustrative of the gradual changes wrought in the construction of vehicles. In some of them are depicted stage-coach and other modes of travel; in others, the jeering crowds which greeted the first steam carriages, as these crude mechanisms halted midway on a steep hill, or were imbedded in the mire. Convivial coaching parties are gliding swiftly

The British collection consists mainly of the bicycles best adapted to the excellent roads for which that country is famous. Here and there are a few tricycles, and several firms display such specialties as cold-drawn steel tubings, tires of peculiar make, and other parts of the machine; but as a rule the score of manufacturers who have organized this department confine themselves to the modern bicycle in its entirety. A Coventry firm has on exhibition more than thirty specimens of safeties alone, some weighing only 18 and none more than 30 pounds, the finer grades furnished with the twisted tubing which is only used in their construction. A Birmingham company has a large assortment installed in a richly furnished section, finished in mahogany with a neat office in the centre. Its standard machine weighs 37 pounds, the racer being only about half as heavy, and as one of its specialties is shown a bicycle for women. In the section containing a Nottingham made machine is a large case filled with medals, cups, and other prizes won by its rider, now generally recognized as the world's champion. The company also furnishes a record for 1892 of 100 notable races in which the machine and rider participated, the contests being held in Great Britain, Germany, Canada, and the United States.



THE "NANCY HANKS" SULKY, PNEUMATIC TIRES

along green-hedged English roads, and in another series are shown the start, the mishaps, and the conclusion of the first recorded steeplechase. Caricatures are plentiful, both of Irish and English travel, and in hundreds of drawings, here and along the front sections of the gallery, are displayed in outline the construction of state coaches and foreign vehicles, with the heraldic devices placed upon them. Here is an early Spanish coach, there a French carette, and a few feet away the lord-mayor's carriage of 1757, and the magnificent car of state in which rode Louis XIV.

Among the members of the institute who have contributed to this collection are Hooper and company, carriage builders to the queen and to the prince of Wales, and the Coach-makers' company, of London, among the rare drawings furnished by the latter being one of the state-coach said to have been used by John V of Portugal, in 1706.

Among the groups of curios arranged along the front of the gallery is an array of cruel looking spurs, with massive specimens in brass and silver dating from the seventeenth century, and an antique war bit champed by the mailed-steed of a crusader of the middle ages.

In the British section also transportation by sea and land is illustrated by a collection of models from the government of Ceylon, where the visitor may observe the difference

in the construction of the bullock-cart used on low marshy ground and the one adapted to the highlands; or he may see in miniature a carrying chair, a gravel wagon, and a racing cart. Models of boats there are whose outlines are somewhat unfamiliar, especially the catamarans and the outrigger canoes. The latter carry enormous sails, and it is said that the winds that ruffle Ceylonese waters are known as one-man, two-man, and three-man breezes, according to the number of men required to perch on the outriggers in order to keep the craft from capsizing. The double canoes, or fishing boats, the originals of which are made of del wood, closely resemble ice boats. A group of apparatus characteristic of the Holy Land, a contribution from the United States consul at Jerusalem, is composed of



AUTOMATIC FIGURES IN MOTION



DISPLAY OF A CHICAGO COMPANY



A TURKISH CONVEYANCE

leather bottles, water-skins, mule-packs, jars, bags for carrying babies, and baskets for holding horse feed. Near the model of a boat, such as has been used for centuries upon the sea of Galilee, is a small wooden frame propelled by children while learning to walk.

North of the British gallery section, the Japanese department of communications has an exhibit supplementary to that of its hydrographic and naval bureaus, presently to be described. Here are maps portraying the principal routes of coasting steamers and charts indicating the monthly average of wrecks in given sections, together with the location of light-houses. There are also traced the railway systems of the country; and statistics are plentiful as to the extent of their interests and these of the merchant marine. There are numerous models, from those of the ubiquitous mule which appears to be the common carrier of mankind to the passes of the Usui mountains, showing the Abt railway system and the great bridges over the rivers Kurobe and Nishiki. Additions have been made to the original bridges completed in the 17th century, but the portions built



GENERAL VIEW OF THE EXPOSITION GROUNDS

in that era are still considered remarkable feats of engineering. The structure thrown over the Kurobe, called the Aimoto bridge, is of the cantilever pattern, with a span of more than 160 feet.

North of the Japanese section, and occupying the entire northern aisle, is a large collection of miscellaneous exhibits, as saddles, bridles, and harness; wagon, carriage, and saddlery hardware; carriage lamps, axles, and springs; collars, chains, halters, and blankets, wheels, and hubs; rubber steps, dashes, and fenders; boots for liverymen and leather overalls for cowboys. Some of the groups consist entirely of whips, as that of a Chicago company which manufactures at the rate of 10,000,000 a year. The monotony of these exhibits is somewhat relieved by the groups on either side of the northern entresol, one of them in the form of a saddle, harness, and cart from Palermo, Sicily, the trappings decorated in the highest style of Sicilian art and bedecked with ribbons presenting all the hues of the rainbow. The saddle is surmounted by a red plume and the collar band studded with small glass mirrors. Of the cart itself, every square inch of its body is brightly painted with figures, the spokes, hubs, and felloes with alternate stripes of red and blue. It is a national conveyance, used either for the carriage of commodities or for the conveyance of visitors to local fairs and wedding feasts.

At the opposite end of the northern gallery are photographs and models illustrating the modes of transportation prevailing in South America, their subjects ranging from railway stations and railroad scenery to brute and human pack carriers. Among them are the llama and his burden, the mule driver of Colombia, the

mounted milk-woman, and also the native carrier of the Andes with a traveller's chair strapped securely to his back.

At the gateway to the bicycle and marine exhibits of the United States, the island of Madeira furnishes a unique contribution. First there is a large coach curtained, roofed, and travelling on runners on streets so slippery that wheels would be of no avail. Upon a rear seat the driver urges on the bullocks which drag this odd-looking conveyance over the paved highway. Here also is shown the mountain sleigh, upholstered in red, which slips down the precipitous and well travelled heights with the velocity of a locomotive. Another means of conveyance here reproduced is a mountain hammock, resembling a sedan, which, attached to poles, is carried with its human freight among the mountain peaks of Madeira.

Not far away is a small museum in which are represented ancient types of vehicles. Here is a reproduction of a racing chariot exhumed from a Theban burial ground, and of which the original, in the royal



FROM A POINT NEAR THE WOMAN'S BUILDING

museum of Florence, is probably the only vehicle that has survived the pre-Christian era. Beside it is an unwieldy ox-cart, such as was used by the Pueblos of New Mexico. In the cases which partially surround this exhibit are some of the oldest railroad tickets and announcements issued in the United States, with similar contributions from the railways of Japan.

In the United States exhibit of bicycles, more than forty of the leading manufacturers participate. The display is organized almost on the same plan as that of Great Britain, some of the exhibitors showing special parts of the machine, but the majority presenting the entire mechanism. Many of the collections are housed in handsome pavilions, and not a few are in charge of well-known experts who have won for themselves a wide record while using the machines whose numerous merits they explain so graphically to the interested visitor.

Chicago is well represented in this section, several of the larger factories making a somewhat elaborate display. The Western Wheel works have, in addition to bicycles of many patterns, wheel chairs and children's carriages, all very tastefully arranged in their neat and spacious pavilion. In the specimens prepared for exposition, the Stokes Manufacturing company has avoided the use of enamel nickel plate that the visitor may better judge for himself as to their material and workmanship. The Gendron Wheel company, of Toledo, has one of the largest collections on exposition, including bicycles, tricycles,

velocipedes, children's carriages and sulkies. In a structure composed of brass, a Boston company shows in several styles its bicycles with weldless steel tubing. Beside the perfected machine of 1893 are the parts of which they are composed, either as unwrought material or in various stages of manufacture. There is also a model of the English dandy horse, with the first bicycle worked with pedals, of Parisian make, the first safety, which appeared in 1877 in Boston streets, and the now antiquated machine on which Stevens made his tour of the world. Finally there is a bicycle fashioned for military service, one that has recently been adopted by the army department.

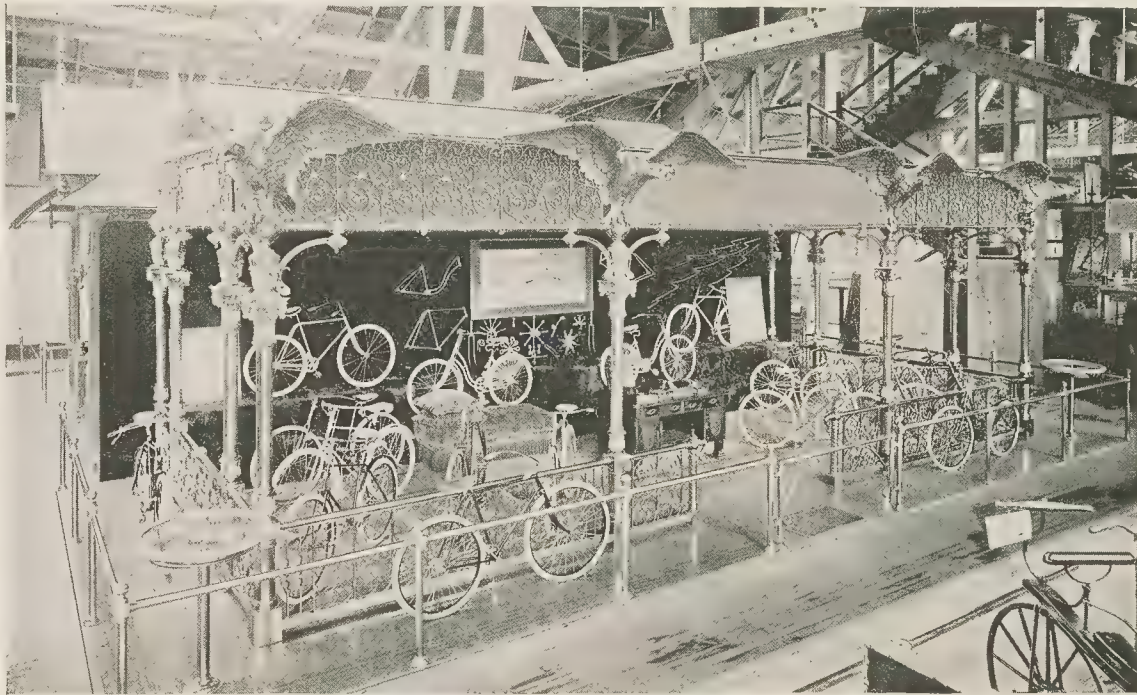
Other features in this division are wooden bicycles from a Newton company of Massachusetts. An exhibiting firm, dissatisfied with its space and position, placed two of its

machines upon the gallery railing, the treadles automatically worked by a youth and maiden. A group finished in rainbow tints is among the many ornamental specimens contained in the department.

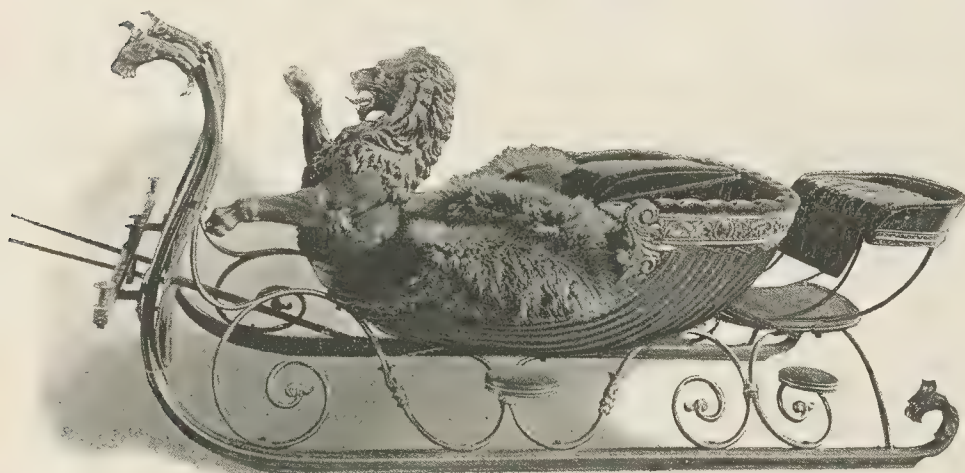
About midway in the eastern gallery, near the southern end of the bicycle exhibit, are the tent and

palanquin in which Mrs French-Sheldon lived and travelled during her journey of 1,000 miles into the heart of the dark continent, attended only by her retinue of Africans. The palanquin is built of bamboo and aluminum, and contains a bed, an adjustable table, and lockers for wardrobe and toilet articles. Around it is reproduced the scant herbage of the desert; here also are the boxes in which Mrs Sheldon stored her supplies and her presents for native tribes.

In the marine division of the Transportation department the most interesting exhibits are the Columbian caravels and the Viking ship of the Norsemen, reproduced as nearly as possible in fac-simile, just as they sailed the seas many centuries ago. After crossing the Atlantic and taking part, as I have said, in the naval review in New York harbor, early in June the caravels arrived, by way of the lakes, off Jackson park, where, as at every port of call, they were received with welcome and ovation. With her four

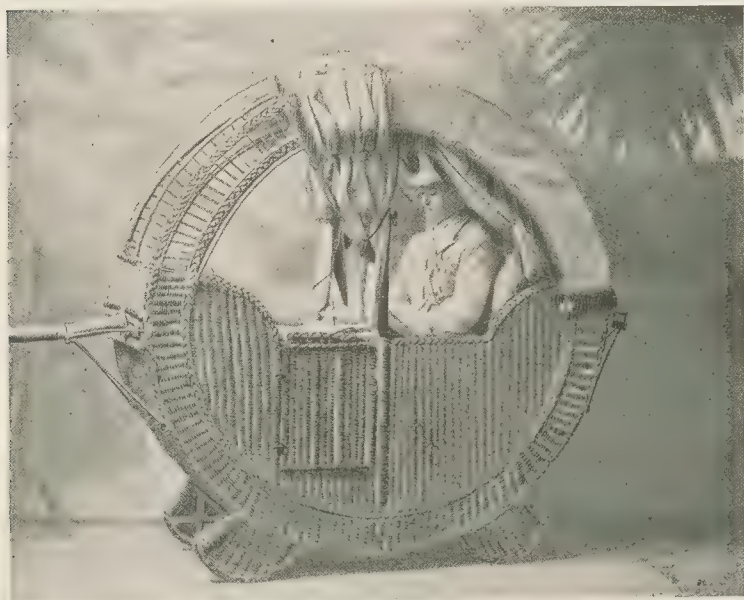


DISPLAY OF BICYCLES



ORNATE RUSSIAN SLEIGH

Mrs French-Sheldon's palanquin



MRS FRENCH-SHELDON'S PALANQUIN



COACH OF THE LORD-MAYOR OF LONDON

decks, her breast-high bulwarks, her poop some twenty feet above water line, and masts and rigging too heavy for her size, the *Santa Maria* is an ungainly looking craft, one that, without the aid of steam tugs, it would have been impossible to handle on her 9,000 miles of ocean, lake, and river navigation. Of the three craft, this is the only one fitted and furnished throughout to resemble the original type, so far as could be reproduced an obsolete style of naval architecture and equipment. Suspended over the main hatchway is a long-boat



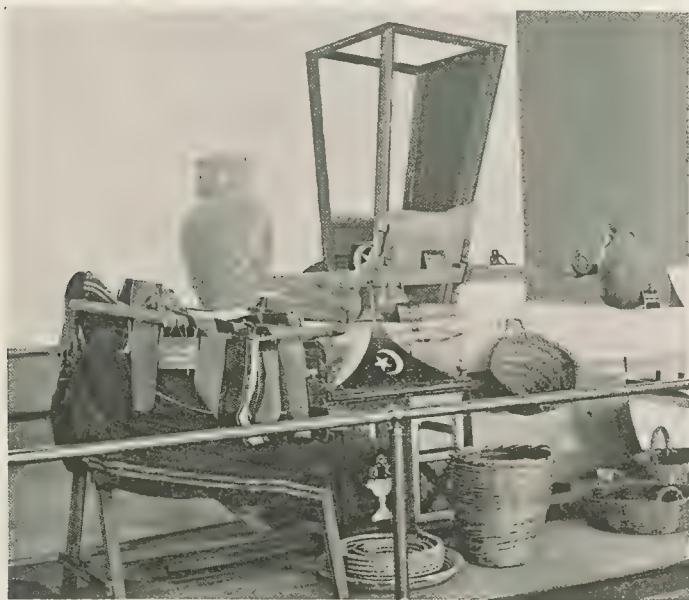
THE VIKING SHIP MOORED NEAR THE "ILLINOIS"

similar to that which the vessel carried, the only one on board. Coiled around the deck are ropes of curious pattern, and the hawsers, nearly half a foot in diameter, are strong enough to hold a first-class man-of-war. There are no capstans, sails and anchors being worked with ropes hauled by main strength. Aft of the ship

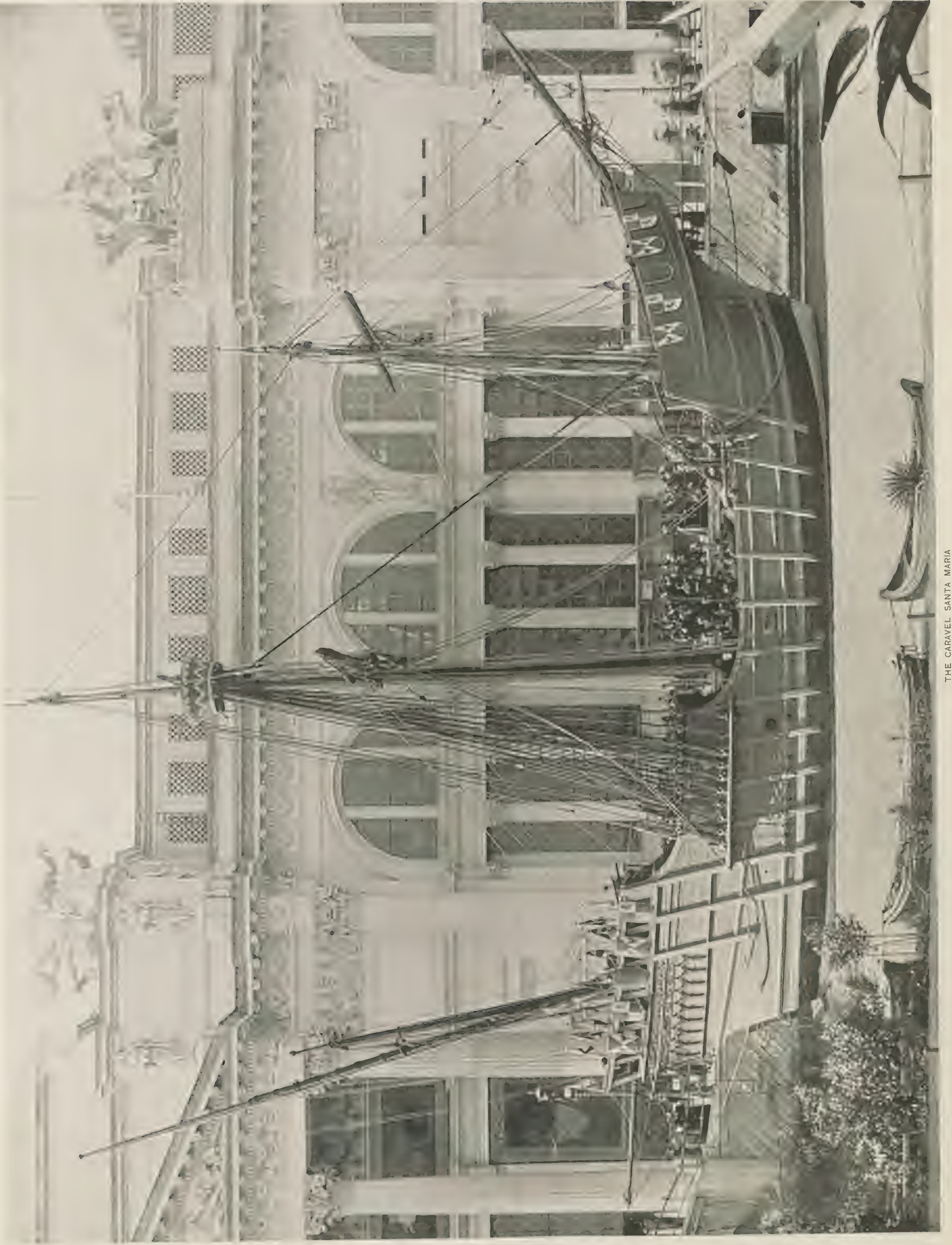
is the admiral's cabin, with its cramped quarters suggestive of bodily discomfort, its narrow bedstead covered with a counterpane of red damask bordered with lace. Here are numerous relics, including, as is said, the table which Columbus used; his chart, his inkstand, and the nautical instruments of the day; with the flag presented by Ferdinand and Isabella, its white field with cross of green, and on either side the initials of their catholic majesties.

The *Pinta* is similar in shape to the *Santa Maria*, though of smaller dimensions, and the *Nina*, with her leg-of-mutton sails, is little better than a row-boat, not larger in size than the bireme of the Greeks. But as to these vessels no further details need here be added to the hundreds of descriptions published in the current literature of the day. All the three craft were presented to the government of the United States, and at the close of the Exposition would be cared for by the naval department.

Of the *Viking* ship, resembling the vessel in which,



FROM THE HOLY LAND



THE CARAVEL SANTA MARIA

as is claimed, a Norwegian navigator discovered the North American continent nearly a thousand years ago, the following is briefly the story. During the winter of 1879 a sailor, living at the port of Sandefjord, employed his spare time in exploring a mound on the outskirts of the town, where, as tradition related, a Viking had been buried with all his earthly belongings. In this ancient Saga legend the towns-folk had little faith; but the sailor persisted, and after digging a square hole not many feet in depth, his spade struck a solid oak plank, which proved to be the side of a ship. Thereupon the royal university of Christiania sent men to inspect the relic, and in early summer, when the frozen earth could be cleared away, it was found to be the genuine craft of "a Viking old," whose skeleton, encased in armor, still kept guard over his treasure, its wood-work, oars, and equipments all well preserved after the lapse of many ages.



The vessel was repaired and removed to the university, where now is its home, and as the approaching Columbian Exposition began to be the talk of the world, it was determined to send there her counterpart, manned by Norwegian sailors and unattended by any other craft, in order to prove the feasibility of Leif Erikson's alleged expedition, more than nine centuries ago, from Norway to the New England coast. Thus from Sandefjord the vessel built by public subscription, in the spring of 1893 set sail for New York, and in the middle of July anchored off Jackson park. To call her a ship is somewhat of a misnomer, for she has no deck, and carries but little sail. Rather is she a large open boat of some 27 tons, more than 70 feet long and 16 in the beam, with 32 oars, each 17 feet in length, her bow and stern far above her body and her clinker-built planks overlapping like the weather-boarding of a house. Her lines are remarkably beautiful, resembling those of a yacht, the convex curvature of the keel increasing her strength and steadiness of motion. Such is the vessel in which a crew of Norwegian sailors crossed the Atlantic and the lakes, sleeping on reindeer skins and

cooking their food as best they could in the bow of their unsheltered craft.

Reëntering the Transportation building through the golden doorway, the first object to attract attention is a beautiful model of the *Santa Maria*, loaned by the city of Genoa. Beyond this is a broad beamed, battered, old-fashioned craft, with but the faintest traces of paint, one that was certainly not placed here for ornament, and of which the following placard explains its presence: "In this boat, on the morning of September 6, 1838, Grace Darling, then 22 years of age, with her father, rescued nine people from the wreck of the *Forfarshire*, at Longstone, on the Farne Islands." There is no self-righting or other of our modern apparatus wherewith to do battle against winds and waves — nothing but sound

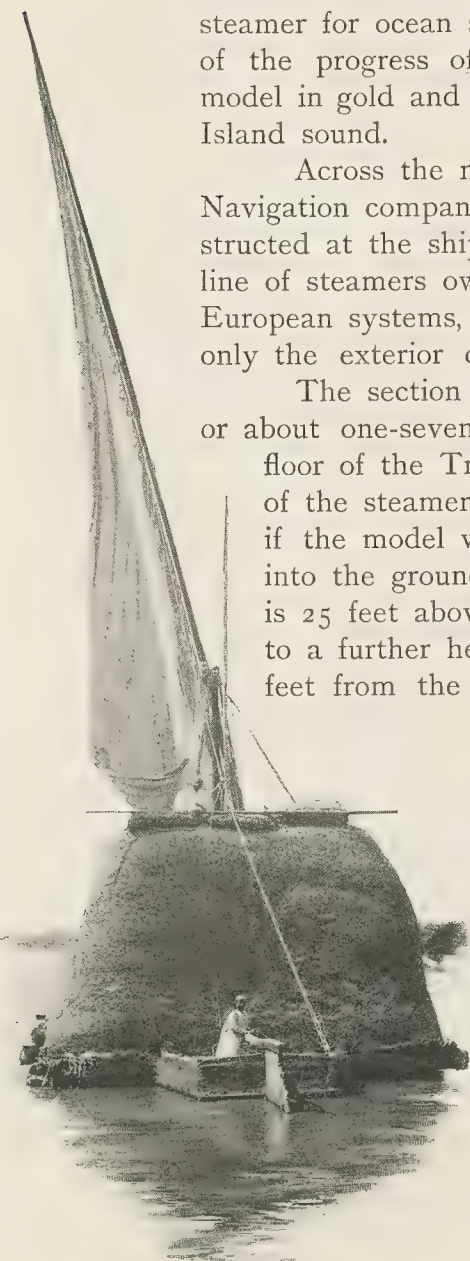


GRACE DARLING

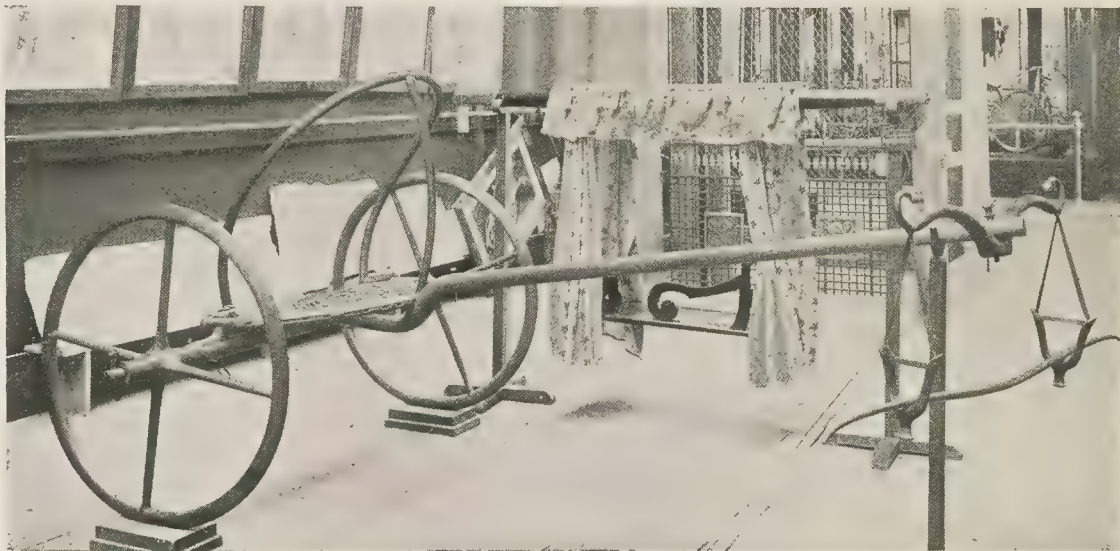
timbers, sturdy arms and the courage which wrought one of the most heroic deeds that history records.

Turning to the marine exhibits of the United States, we find only a small portion of them on the main floor, adjacent to the German section. Here are life-preservers and life-boats, pleasure boats, launches operated

by steam, gas, naphtha, and gasoline, and in the midst of all a caique which has seen service on the Bosphorus and the Golden horn. Of modern pleasure boats there is a fine collection from Thomas Kane and company, builders of the electric launches which ply on the waterways of Jackson park. In this vicinity are many other specimens of small, light craft, with marine hardware, ships' anchors, steering, hoisting, and other nautical apparatus. There are also models of well-known steamships, the most complete exhibit of this character being that of the Harlan and Hollingsworth company, of Wilmington, Delaware, whose progress in marine construction is exemplified in a gallery of pictures and models of the schooners, yachts, tugs, ferry boats, steamers, and propellers built at its works during more than half a century. Altogether more than 300 vessels have been constructed, includ-



AN EGYPTIAN HAY BOAT



ANCIENT WAR CHARIOT OF SCYTHIA

ing, as is claimed, the fastest steamboat in the United States, the first iron screw steamer for inland service, the first iron steam pilot boat, the second largest transfer steamer in the world, and the first iron steamer for ocean service, completed in 1844, these and others forming a chronological panorama of the progress of ship-building in the United States. In this pavilion is also a working model in gold and silver of the machinery in one of the company's iron steamers running on Long Island sound.

Across the main aisle near the southern entrance-way, is the exhibit of the International Navigation company of Philadelphia, consisting of a full-sized section of a steamer now being constructed at the ship-building yards of William Cramp and sons. As this is the only transatlantic line of steamers owned in the United States that will bear comparison with the Cunard and other European systems, the display is of special interest to American travellers; for here is shown not only the exterior of the vessel but all its internal arrangements, furnishings, and equipments.

The section is more than 70 feet long by 35 in width, or about one-seventh of the entire length of the ship. The floor of the Transportation hall represents the water line of the steamer, which is 26 feet above the keel, so that, if the model were complete, it must sink that distance into the ground. As here it stands the promenade deck is 25 feet above the floor, above which rises the funnel to a further height of 53 feet, thus giving a depth of 104 feet from the top of the funnel to the bottom of the keel, the former almost touching the roof truss of the building, and painted black with a band of white, as the distinguishing mark of the company, to which belong the well-known steamships, *Paris* and *New York*. The sides are studded with port-holes to a height of 17 feet above the floor, where the iron plating ends and the railing of the second or saloon deck begins. Above this is the first or promenade deck, and above all, the bridge, whence orders are given and the course of the vessel directed. Entering from the floor, the first compartment contains an array of models of steamers, for one of which, that of the *Paris* a gold medal was awarded at the Exposition of 1889. Next are the steerage quarters, with family rooms and single berths for men, with thorough ventilation and electric lighting, as in other portions



FIGURES IN TURKISH SECTION

of the ship. A stairway leads from the model room to the deck above, where are first and second-class cabins, the former with sofa and extension berths so arranged as to communicate when required for family use. Ascending to another deck, the visitor enters a large, open hall, handsomely finished in dark mahogany and



SUITS FOR RUSSIAN DRIVERS

gold. Passing thence to the right he comes to the dining saloon, with wood-work, chairs, and tables of white mahogany, and with walls and ceilings in light green panellings relieved by silver mouldings. In the centre is an arch of glass panels through which sunlight is admitted by day and electric light by night, its base supported by carved allegorical figures and surrounded with groups symbolical of commerce. At one end of this deck is a suite of rooms, the chamber containing a double bedstead with folding wardrobe and opening into a bath-room, while in the sitting-room the sofas can also be used as



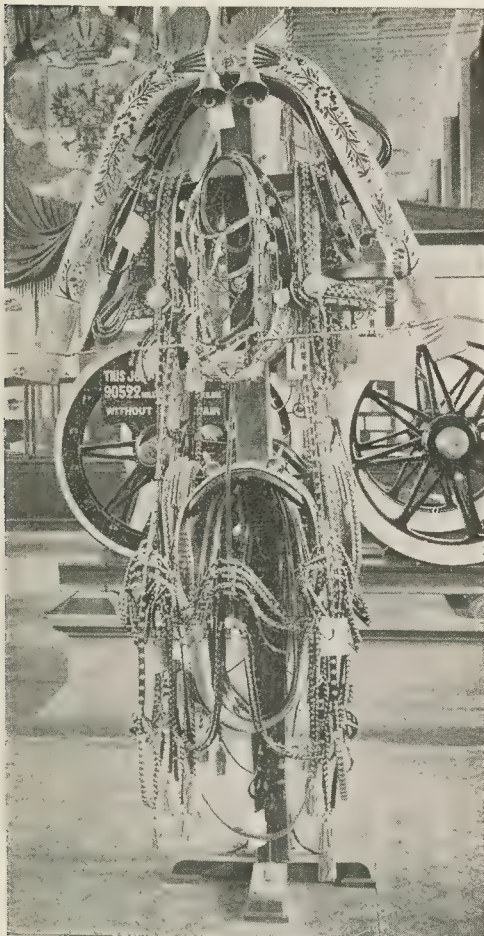
CORDAGE OF THE RUSSIAN NAVY

berths. The decorations of the suite are in ivory and gold, with upholstery to match, frescoed panels and ceiling artistically painted.

The highest or promenade deck is in three divisions, first of which is the hall around the stairs or companionway, corresponding with the one below and the same as to size and finishings. Then comes the library, with wood-work of dark mahogany, ceiling tinted in gold, and lighted by large square windows, above which are smaller windows for purposes of ventilation, the former covered at night by sliding sashes of leaded glass, fitted with electric burners. Seats upholstered in dark plush are ranged along the outer walls, with tables and writing materials. Finally there is the smoking-room, handsomely furnished as are all the rest, with carved mahogany chairs arranged in three sides of a series of hollow squares, and a table in the centre of each.

No wonder that 20,000 persons on an average passed daily through this sectional model exhibited by the International Navigation company. Here is in truth embodied the luxury of travel by sea, with carpeted floors, the richest of furniture, and all the appointments of a luxurious home. By Doctor Johnson a ship has been described as a prison house, with the additional disadvantage of the risk of drowning; but the good doctor did not make his historic journey to the Hebrides on board a modern transatlantic liner.

Passing from the promenade deck, one may step into the gallery of the Transportation building and there commence his examination of the large array of American marine exhibits, extending thence northward for several hundred feet. Here are not only exhibits from every portion of the United States, showing the present status of marine construction and its historic development, but from travellers, naval officers, consuls representing the government in many distant lands, and from foreign commissions are also numerous collections. In this section the main purpose is to illustrate the forms of marine architecture prevailing in the United States, the curios from other lands, serving as a foil to the specimens wherein are represented modern enterprise, ingenuity, and skill. For example, above the large model of a shipbuilding plant are suspended a black wooden canoe from the isthmus of Panama, and a raft of straw from Lake Titicaca, such as are used on the inland waters of South America. Near by is an old batteau, found on the banks of the upper St Croix, in Wisconsin, and contributed by the historical society of that state as an illustration of the



ARTISTIC SADDLERY

French-Canadian style of river craft in the early fur-trading days of the northwest. Though called a canoe, it weighs several thousand pounds, and was built to carry a score of voyagers and traders and a ton of goods.



AFRICAN BOAT MADE OF LOGS

are Alaskan canoes, in one of them the figure of a native fisherman and hunter armed with weapons of the chase. Here an Australian bark canoe may be compared with the Alaskan haida of cedar, and a boat from Hammerfest, Norway, with models of the craft which float on Chinese waters. Of all the collective exhibits from foreign lands, that which the Siamese commission has furnished is the most extensive, and the one most thoroughly typical of the country and people which it represents. It consists of about 100 models, including ponderous junks, in shape not unlike the Spanish caravels, and low tapering boats with sharp bows, similar in shape to racing shells, but inlaid with gold and pearl and otherwise decorated in oriental fashion. There are also craft intended for river service, for the sea, and for fishing and pleasure boats. In another department are models of carts, coaches, and sedans, both for common use and for weddings, festivals, and state occasions.

Turning again to the exhibits representative of modern naval architecture, may first be mentioned that of the Union Iron-works in San Francisco, near the gallery exit from the model displayed by the International line. Suspended from the roof of a handsome pavilion, broad festoons of silk serve as a canopy for realistic models of its workshops, ship-yards, docks, and vessels in process of construction or afloat on the waters of the bay.

In a section opposite is a relief map of the Nicaragua canal, a working model illustrating the projected system of locks, excavations, and dams. The map, which covers about 100 square feet, is constructed

Not far away are beautiful models of the Columbian caravels, with whose outlines we are familiar, and a number of cases filled with tiny models of Hindoo chairs, carts, rafts, boats, and canoes, with illustrations of the marine architecture of India, ranging from the luxurious barge of state which plies on the lake of Kashmir to the rounded piece of wood on which the native lies face downward, propelling himself with his feet and fishing as he goes.

In another section is a Venetian gondola, finished and furnished in ebony, near which



SECTION OF AMERICAN STEAMER



STATE ROOM OF AMERICAN STEAMER

into the so-called Tola basin, and then set adrift in another cut, representing a canal eight miles in length. The distance from the Pacific ocean to Lake Nicaragua is only twelve miles, but from this side much of the heaviest work is yet to be accomplished, including the blasting of solid rock 70 feet in thickness. The route projected is across the lower end of the lake, south of the inactive volcanoes of Ometepe and Madera, past old Fort San Carlos, where light dredging is to be done through volcanic ashes, and into the Rio San Juan, through which for 64 miles it runs to the commencement of the eastern artificial channel. The channel, which is more than 30 miles long, contains three locks, and thus at length the vessel passes into the harbor of Greytown and the Atlantic ocean. Of the total distance from sea to sea, nearly 170 miles, Lake Nicaragua, San Juan river, and the natural basins furnish 142 miles of free navigation.

In an adjacent section is illustrated the construction of the huge log rafts and towboats of the Mississippi, and opposite is a collection of models, photographs, and paintings, showing how whaleback barges and steamers are built

on a vertical scale of one to 2,000, and a horizontal scale of one to 30,000, this proportion allowing the engineering details to be plainly indicated, the points where work is being done or has been projected, being shown by patches of red. Lead pipes are molded into the ground work of the map, and when the water turned into them fills the beds of Lake Nicaragua and the San Juan river, the nature of the enterprise is at once understood. From a dam constructed about midway between the reservoir and the Atlantic, the waters of the river can be raised to a level with those of the lake.

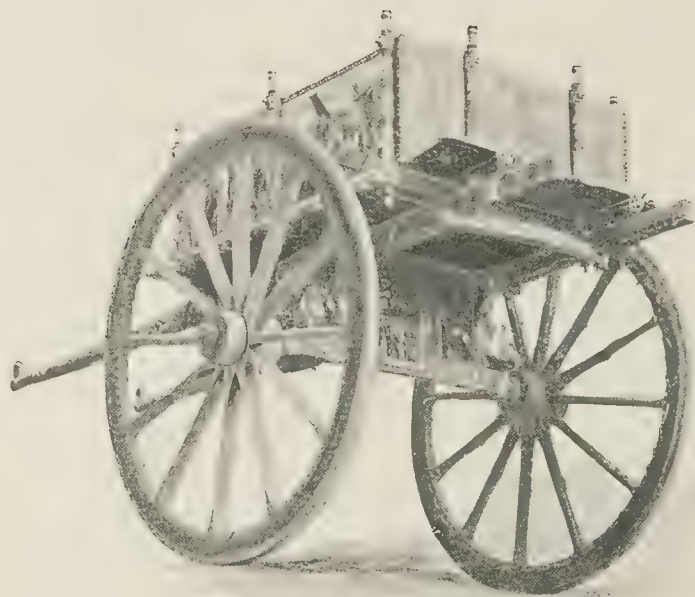
In order to float a chip, which here represents a vessel, from the Pacific to the Atlantic, it must first be carried into a miniature canal cut for a mile and a half through the rocky ridge of the continental divide, lifted over three locks



DINING ROOM OF STEAM-SHIP



MADEIRA'S BULLOCK SLEIGH



PAINTED CART FROM SICILY



MOUNTAIN SLED USED IN MADEIRA



COLUMBIAN INDIAN WITH CARRYING CHAIR

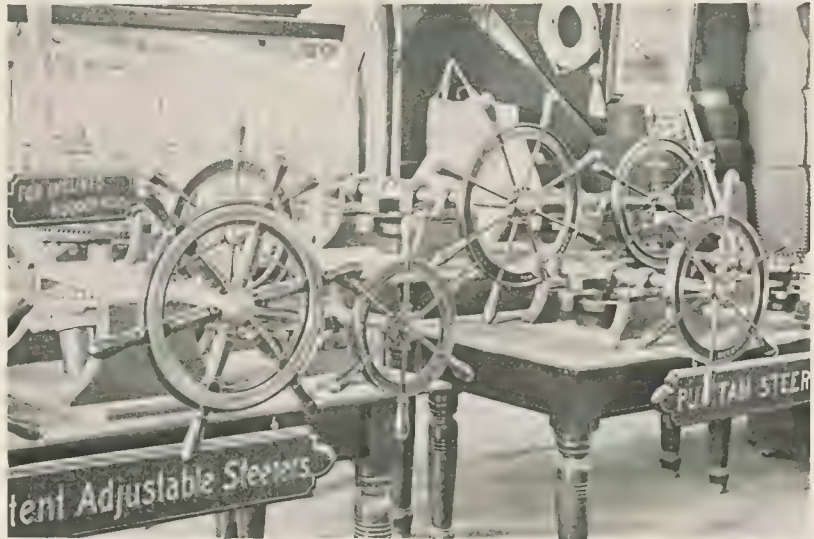


CARRIERS OF SOUTH AMERICA



SUITE OF STATE ROOMS

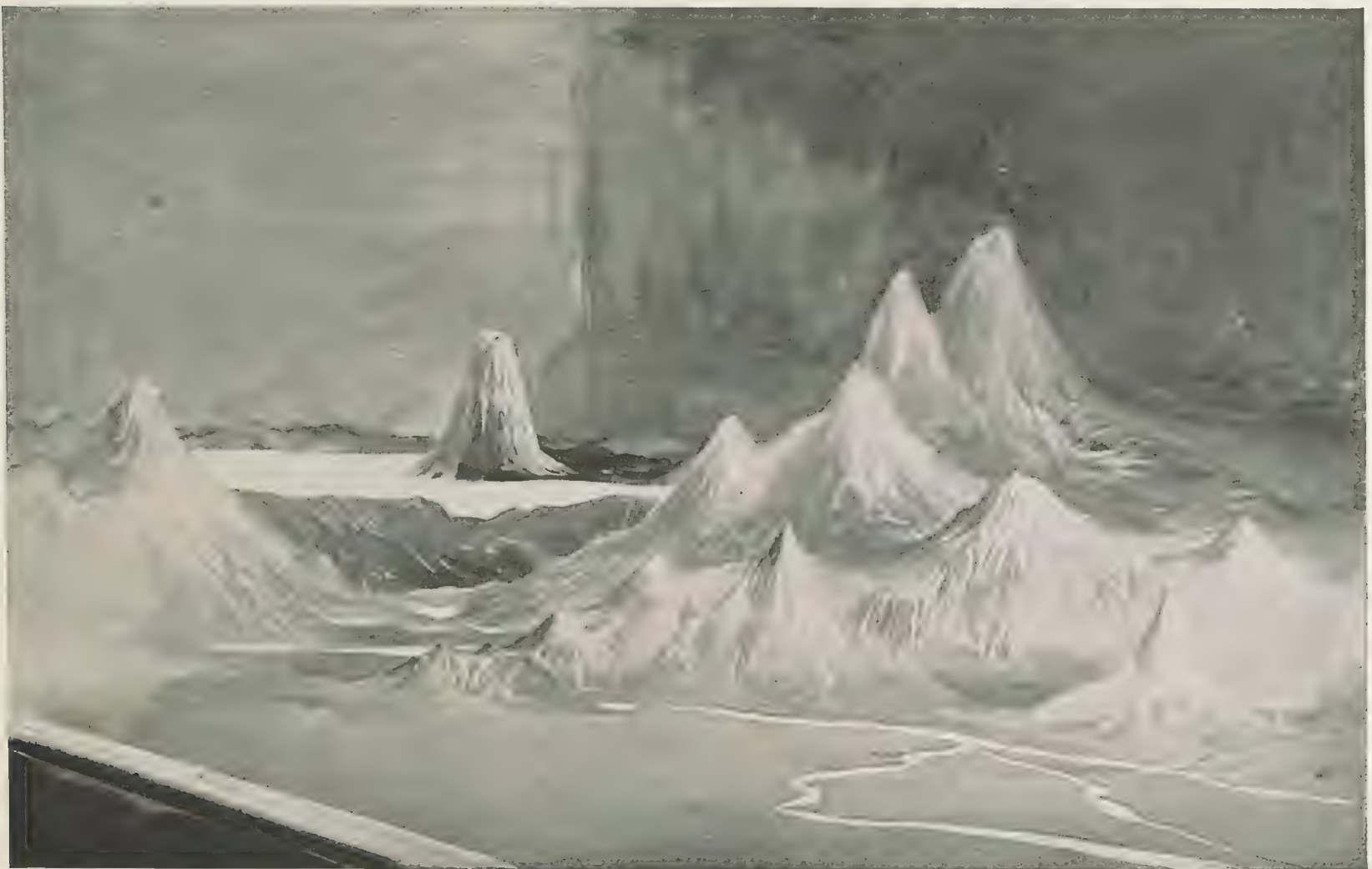
at the yards of a company whose headquarters are at Superior, Wisconsin. Near by is a relief map, resembling rather a plaster model of St Thomas island, in the Danish West Indies, by Charles E. Taylor. Here are reproduced, with remarkable fidelity of detail, the waves of ocean



STEERING APPARATUS

breaking on the shores, the fringes of cocoa palms that surround the island, the ships in the harbor, including the caravels which touched there, the dry docks, fishermen's huts, and the houses and streets of the seaport. Around it are terra cotta plaques and photographs presenting views of the island scenery upon a more extended scale.

In another relief map is shown the entire canal system of the state of New York, with the topography of the adjacent country clearly illustrated. This is the work of Martin V. Schenck, state engineer and surveyor, and with it are models of the doubled and lengthened locks, showing how the products of the west are conveyed rapidly and cheaply to the seaboard. Of historic interest is the model of the original lock built at Little Falls



MODEL OF NICARAGUA CANAL



BLOCKS PULLEYS AND HOISTING GEAR

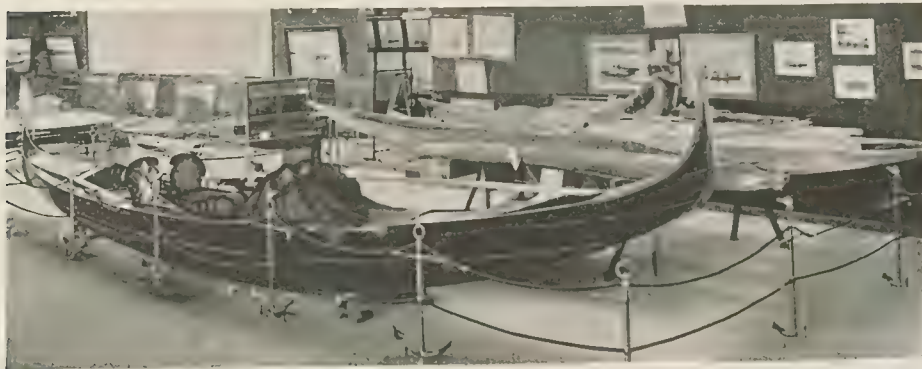
historic and pictorial. In the centre of a boat, for instance, are the original engine and boiler of the first twin screw steamboat, built by John Stevens, of Hoboken, New Jersey, in 1804. This is a portion of the exhibit of a ferry company of that city, and adjacent to it are models and pictures from a New York company, showing the architectural evolution of the steamers which ply on Long Island sound, from the Fulton to the latest craft launched from New England ship-yards.

Harper and brothers and other publishing houses have selected from the best of their art works, extending over many years, sketches, drawings, and engravings, representing modes of transportation

among many peoples and countries, ranging from the war canoes of the Congos to the cruisers of the white squadron, and from the bullock cart of Siam to the steam leviathans of modern railroads. In one section may be traced the development of our naval architecture, and in another is shown the excitement produced in the



MUSEUM OF MARINE MODELS



VENETIAN GONDOLA AND ALASKAN BOAT

in 1795. In still another map covering an entire wall is shown the water route from New York to Duluth, and there are photographs of canal steamers, aqueducts, and points of interest along the Erie route, with statistics covering the entire history of the system.

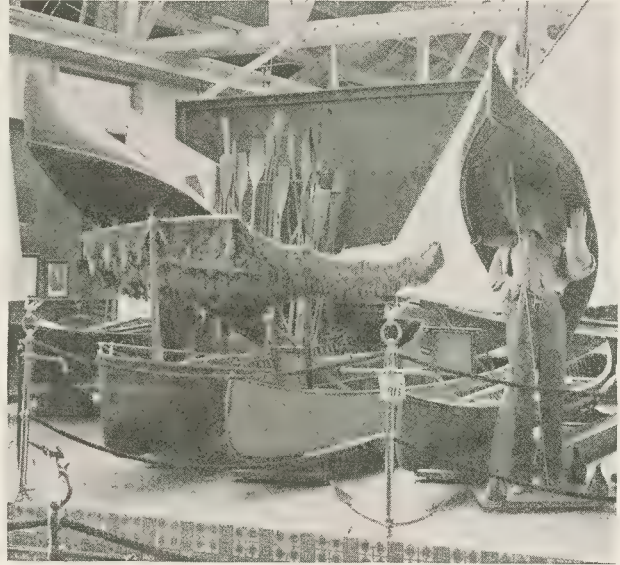
In a modest booth, not far away, the state commissioners of Maine have models of famous ships which have sailed from their ports, and in a corner of this section is a small old-fashioned cannon, captured from the British brig *Boxer* during the war of 1812. Beyond a pavilion which contains the models of the ship-yard and steamers of a Virginia company, the exhibit is largely

land of the Pharaohs by the advent of the bicycle. In addition to these collections are several galleries filled with paintings of marine subjects. Among them are scenes along the coast of Jersey, some of them depicting the dangers that confront the pilots of Sandy hook. Here also is Farragut's fleet and the harbor fronting the World's Fair city. But the most complete exhibit, one illustrating the development of the merchant service of the United States together with ingenious types of oriental craft, is that of the Essex institute

and Peabody academy of Massachusetts. Salem is one of the oldest seaports in the country, and the pictures of her ships, some of them water colors by Ross Turner, cover the period from 1765 to 1893. There are also



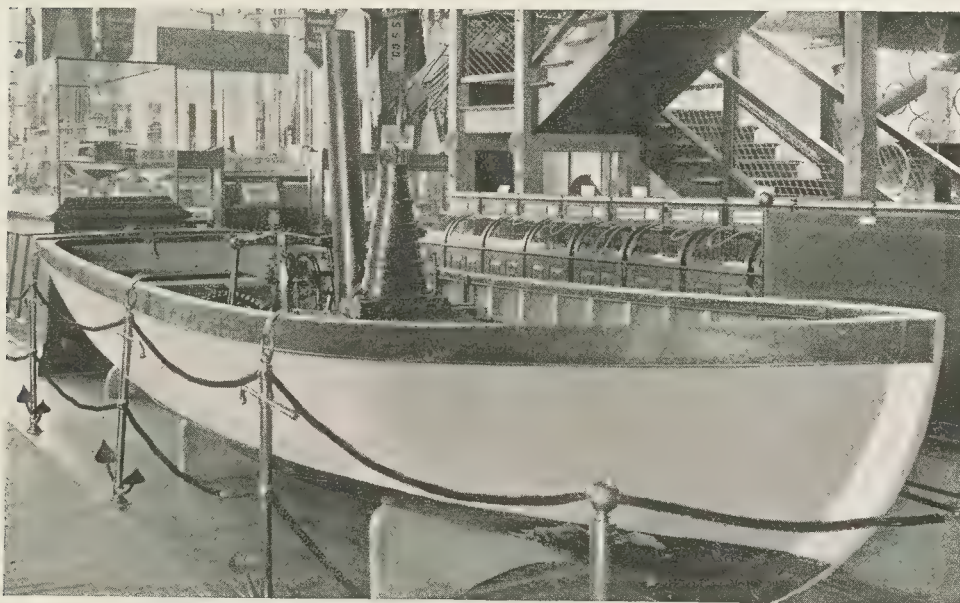
BRAZILIAN CRAFT



OF INTEREST TO SPORTSMEN

models of old English frigates, as of the *Sovereign of the Seas*, launched in 1637, in contrast with which are those of Chinese freight and fishing craft, and a mandarin dragon or racing boat.

The marine display of Great Britain is on the ground floor of the Transportation building. Here is a complete representation of the history of British ship-building for more than three-score years, showing the progress made in the construction and equipment of her naval and merchant service, her steamers and sailing vessels, torpedo boats, launches, tugs, and the craft used for river and lake navigation. By the Thames Ironworks and Shipbuilding company is illustrated in models the development of the British iron-clad, beginning with the *Warrior*, launched in 1860, and then believed to hold the navies of the world at her mercy. Her armor, more than four inches in thickness would resist a 68-pound shot, then the heaviest projectile used, and as was thought the heaviest that could be used; but year by year the invention of more powerful weapons called for heavier armor,



TWIN SCREW AND BOILER OF "JOHN STEVENS" BOAT

until to-day 20-inch plates are considered none too thick for a first-class line-of-battle ship. In other models the history of naval architecture is brought down to the present time, the list including the *Minotaur*, successor to the *Warrior*, but of larger size, the *Sanspareil*, of 10,500 tons displacement and 14,000 horse-power, and the steel cruisers *Blenheim* and *Theseus*, both with a speed of more than twenty knots. Then there are war vessels built for various foreign nations, with steam and sailing yachts and craft for special service.

From the works of Armstrong Mitchell and company, at Newcastle-on-Tyne, comes probably the largest model of a ship that was ever exhibited. It is that of the ill-fated *Victoria*, reproducing on a scale one-twelfth of the original size, and with all her armor and equipments to the smallest minutiae of detail, a 10,500 ton vessel, 360 feet long and one of the most powerful of her class. Only the star-



FOLDING BOATS FROM MICHIGAN

board side is presented; but in the mirrored background is viewed the entire ship resting on an unruffled sea, amid the accessories of naval warfare imitated in most realistic fashion. The model and its guns are of steel and nickel plate; the anchors and cables of polished steel, with boats in fac-simile, and a netting of wire for protection against torpedoes. Another model is that of the *25 de Mayo*, a cruiser built by this firm for the Argentinian government.

From a Clydebank firm are models of several war vessels, including the *Ramilies*, launched in 1892, one of the most powerful battle-ships afloat, and the *Reina Regente*, a Spanish cruiser which took part in the naval review in New York harbor, with channel and Atlantic steamers, the latter with a speed of twenty-three knots an hour. A London house shows models of torpedo boats and torpedo boat catchers, with one of the *Opale*, built in sections for the French

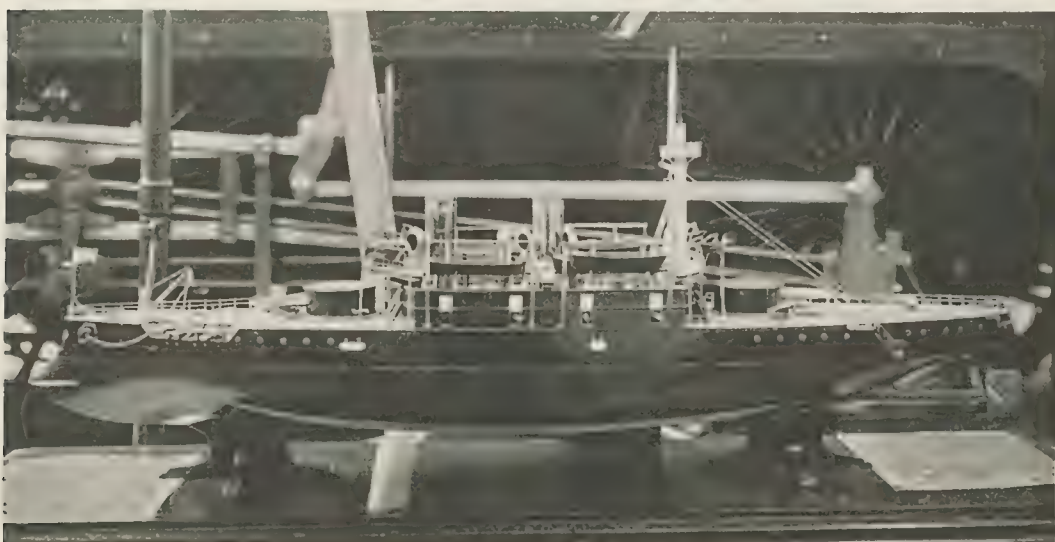


MODEL OF VIRGINIAN SHIP YARD



PORTION OF THE BRITISH MARINE SECTION

government during the Dahomey campaign. From the Sheffield works are exhibits of armor plates and naval apparatus, and from other firms are quick-firing guns, including those of the Nordenfelt and Adamson patterns.



MODEL OF ENGLISH WAR-SHIP

In the display of the Cunard Steamship company are models of its most powerful vessels, beginning with the *Britannia* of 1,139 tons and 740 horse-power, built in 1840, and ending with the *Campania* of 12,500 tons and 24,000 horse-power, launched in 1893, the latter 620 feet in length, or only 60 feet shorter than the *Great Eastern*. All the models were constructed by the company's naval architects, on the scale of one fourth of an inch to the foot. They are contained in glass cases, resting on carved oaken tables, and with ivory tablets descriptive of each of the exhibits.

In smaller models the Peninsular and Oriental company illustrates, in periods of a decade each, the various types of steamers used and now in use since first it took the field, in 1837, with two vessels little

larger than the life-boats which to-day its ocean greyhounds carry. In map form are shown all parts of the world to which its service extends, and information is here afforded as to the progress of naval architecture and engineering during the term of the company's existence. The operations of this company are on a gigantic scale, with nearly threescore steamers plying on the Atlantic, Pacific, Mediterranean, and Indian oceans, representing a value of \$35,000,000, and with subsidies of \$1,650,000 a year from the British and

other governments. In return, more than one-half of their boats are armed as cruisers, ready for instant service, and all are subject at the briefest notice to the orders of the British admiralty.



DISPLAYED BY THE STATE OF MAINE

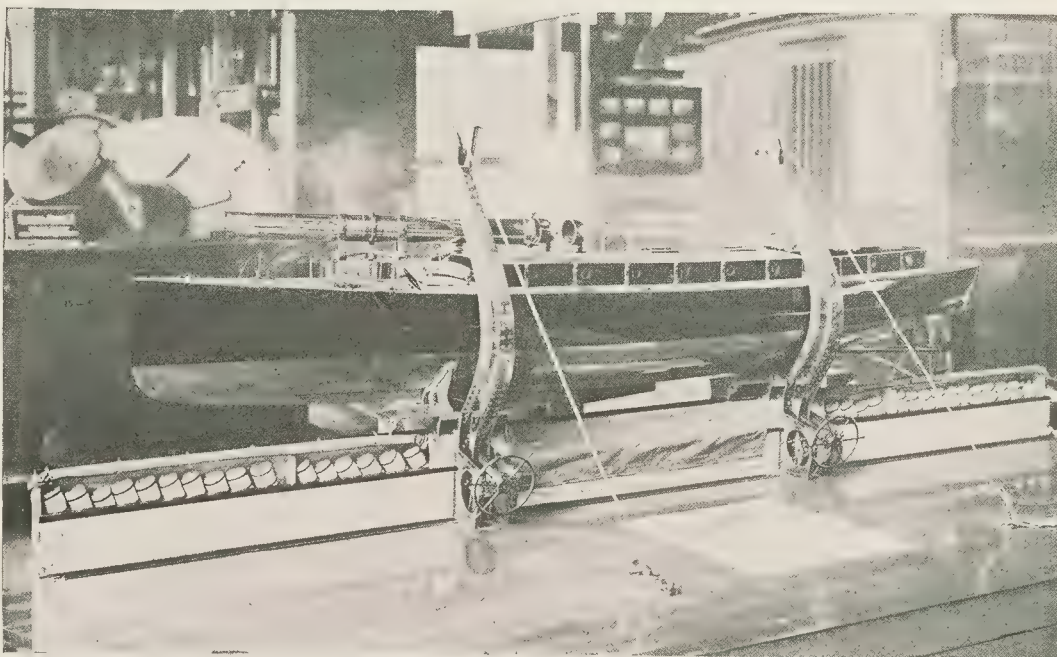


A COSMOPOLITAN TOURISTS' COMPANY

works, and of those engaged in the mail service between England and South Africa. From other firms, models, apparatus, rigging, and naval equipments of many kinds complete a varied and interesting display.

In connection with the British marine exhibit may be mentioned that of the well-known firm of Cook and son, which, beginning operations in July 1841, when a few hundred passengers were carried a short distance by excursion train at the rate of a shilling a head, issued in 1892, nearly 4,000,000 tickets, for routes extending over more than 1,800,000 of railroad, ocean, lake, and river. The display consists mainly of models and publications descriptive of its system of transport and travel in various countries and periods. Among the models are those of vessels built for tourist service on the Nile, one of them, the *Rameses the Great*, being shipped to

From the Laird brothers, of Birkhead, is also an elaborate collection of historic models, one being that of the steamer, *John Randolph*, launched in 1834, and another a reproduction of a steam-yacht built for the Vanderbilts in 1893. Among them are represented vessels built for the Chilean navy, the cause of recent troubles with the United States. The Atlantic Transport line, whose headquarters are in London, reproduces the twin-screw steamers which carry live-stock and meats in the carcass from American to British ports. A West Hartlepool company shows one of its cargo steamers, constructed of steel on the web-frame system, and carrying a dead weight of 6,500 tons. Elsewhere are models of the paddle and screw steamers built at Dumbarton



MINIATURE MAN-OF-WAR

Cairo in sections filling 3,750 cases, and there put together by 400 workmen, with the use of 70,000 rivets. Of dahabeahs, built specially for voyaging in comfort on the Nile, there are several specimens. Here also are models of ancient funeral boats, said to have been disinterred from the tombs of Upper Egypt, 4,000 years ago; and copied from the originals at the royal arsenal at Venice, are reproductions of Venetian gondolas from the 15th to the 19th century. In another model is presented the Egyptian temple of Edfou, a Ptolemaic structure with massive walls and propylon towers, which, in the pre-Christian era, served at once as military stronghold and priestly tabernacle. In photographs are displayed some of the company's offices, forming a continuous chain around the civilized countries of the world.

In the Canadian section near by, the largest of the marine exhibits consists of models of steamships plying between British Columbian ports and those of China and Japan, in connection with the service of the Canadian Pacific railway. A study of these models, in connection with the railroad display already described, will explain



IN THE PAVILION OF A GERMAN STEAMSHIP COMPANY

in part how it is that this powerful corporation is gradually wresting from the United States the most valuable portion of the foreign commerce of the Pacific coast. From private firms are smaller craft, both as models and originals, and by the department of public works at Ottawa is reproduced its system of locks and canals.

Prominent among the ground floor exhibits of Germany is that of the North German Lloyd Steamship company, an organization owning about 60 ocean steamers, with a total registration of some 200,000 tons, running to North and South American, Asiatic, and Australian ports. Its display is arranged in a neat pavilion, and consists mainly of models of its vessels and charts and maps illustrative of its operations, one of the latter showing the exact position of each of its steamers at a given hour of the day. By the Hamburg-American Packet company are shown models of its fastest boats, contrasting strangely with the reproduction of a primitive craft on which they stand.

In the southern galleries are models of ships constructed within recent years for the imperial navy or for the more prominent transportation companies. Among ironclads is the *Kaiserin Augusta*, which held the post of honor in the German squadron at the naval review in New York harbor. In plans and models are also traced the principal inland waterways of the empire, the most striking exhibit of this character being from the imperial canal commission. It includes a reproduction of the harbor and dry-docks at Kiel and a large relief

map showing the course of the northeast canal from the river Elbe to the Baltic, and the physical nature of the country through which it passes. Of the curios in this section may be mentioned the model of an ancient boat, the original of which, 75 feet in length, was found in the frozen marshes of the Baltic sea.

The marine division is but a portion of a collective exhibit of engineering installed in the southern galleries, including plans and models of harbors, railroads, and bridges constructed by the government, with diagrams of public establishments and illustrations, in many forms, of the sewerage, water, electric, and gas

systems of the principal cities of Germany. Most of the contributions are from municipal governments, especially from those of Berlin and Frankfurt. From the imperial capital are publications and plans of its asylums for the insane and epileptic, of public markets and bathing establishment, and of its sewage system, with the places where the fertilizing refuse is deposited. There is also a beautifully constructed model of the Kaiser Wilhelm bridge, with plans of structures of lesser note. A pavilion



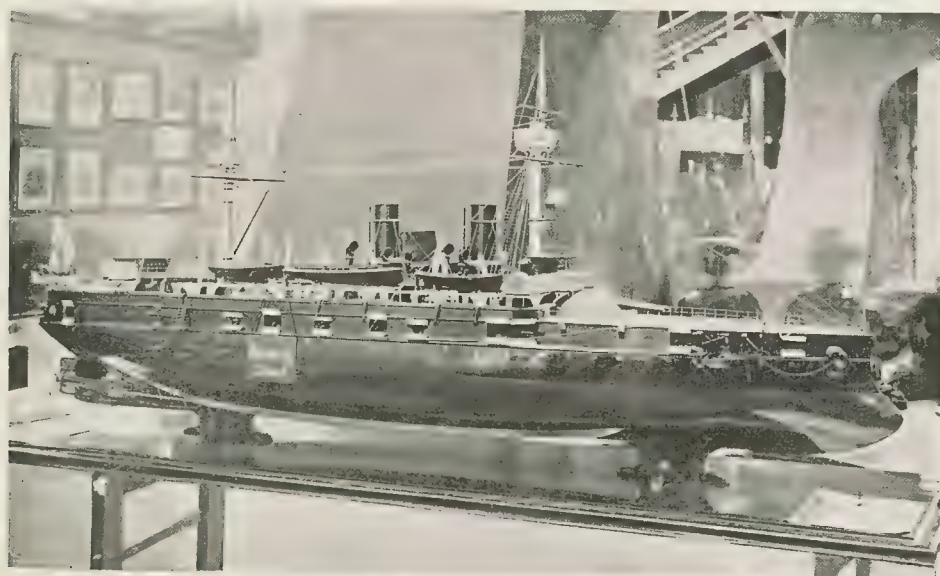
contains the exhibit from Frankfurt-on-the-Main, the chief object of which is to illustrate by drawings, plans, and descriptions the new water supply and drainage works of the municipality. Details are presented as to flooding, ventilation, house-drainage, and siphon construction, and the machinery used for preparing chemical disinfectants and for removing the slime from disinfecting tanks.

In addition to the collections specially prepared by the imperial and local governments, there are private exhibits in the engineering department. One company presents models of various apparatus for distilleries, breweries, starch, sugar, and yeast factories; another exhibitor shows his plans for what he considers model agricultural buildings; and elsewhere are reproductions of pottery works, smelting furnaces, and mining machinery, while specialists indicate how life-boats may be built of aluminium, with the latest ideas regarding the construction of dredging and hydraulic machinery.

In the French gallery section the General Transatlantic company has eight large paintings or dioramas



SCENES FROM THE FRENCH DIORAMA



MODEL OF MAN-OF-WAR

by members of the salon which caused so much comment at the Paris Exposition of 1889. Each picture is at the back of a booth, the entire framework being of a rich maroon, so that the visitor seems to be looking into the scene rather than at it. Now he sees the embarkation of passengers at Havre for New York, with the waving of handkerchiefs, tearful embraces, and farewells. Next is the dining-room with passengers engaged in conversation over their meal, and then the smoking-room where men are enjoying their cigars and wine, their cards and backgammon. Near by are depicted the arrival of an African steamer at Marseilles, and a French boat at the harbor of Algiers, with the workshops of the company and a steamship in process

of construction. There are also models of several of the finest boats, especially those which run between Havre and New York. Another notable feature is the exhibit from the chamber of commerce at Dunkerque,

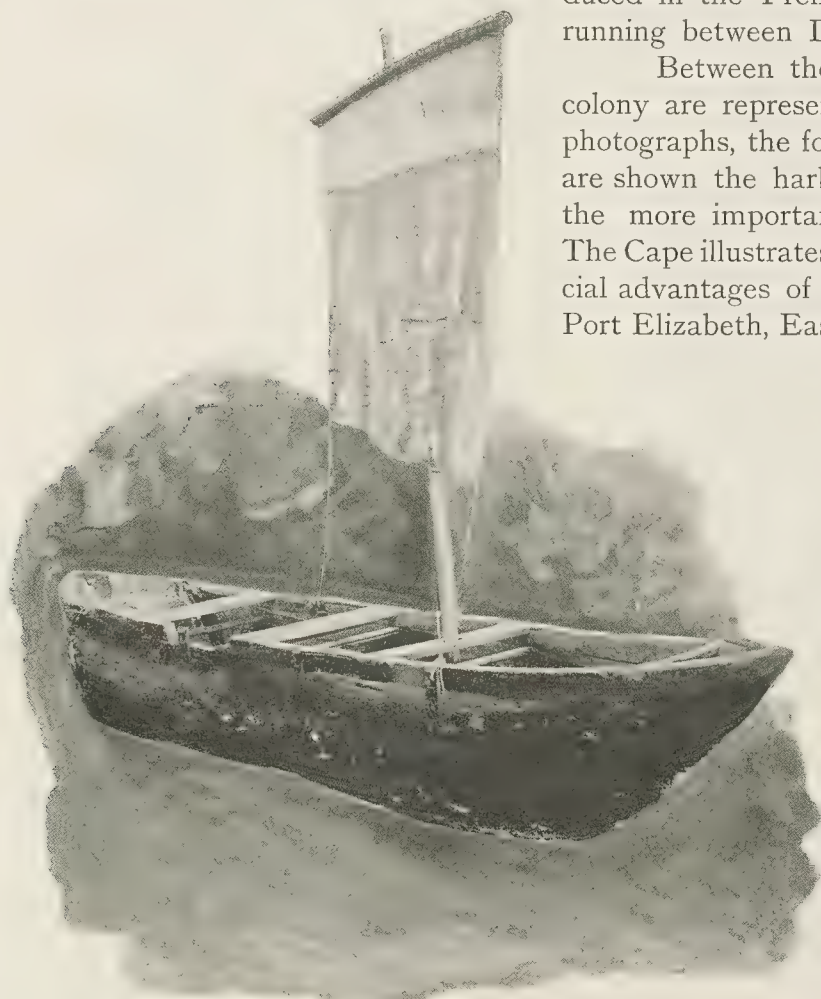
including a mammoth painting and a relief map showing the harbor and dockage system of the port. In this vicinity, as an exhibition of industrial art, are several large screens of opalescent glass. Finally, there is reproduced in the French section on the main floor the cabin of a channel boat running between Dieppe and New Haven.

Between the German and French sections the Netherlands and Cape colony are represented in the gallery by small collections of drawings and photographs, the former contributed by the Royal institute of engineers. Here are shown the harbors of Rotterdam, Amsterdam, and Batavia, with views of the more important waterways of Sumatra.

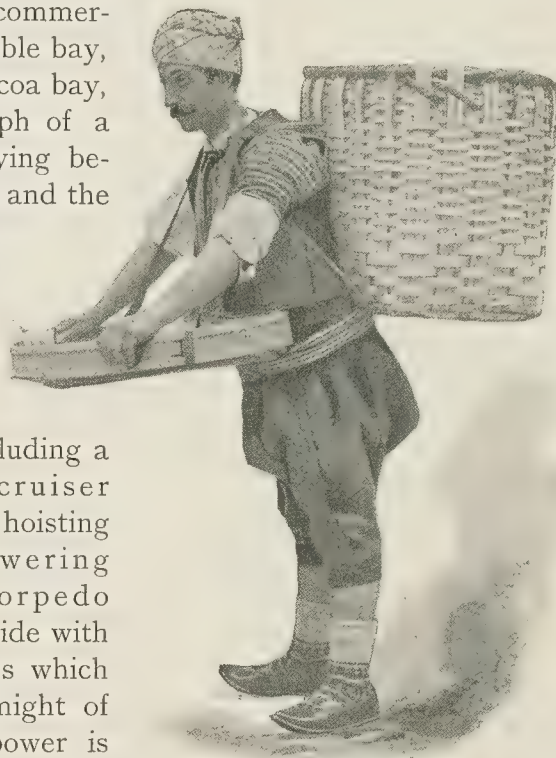
The Cape illustrates the beauties and commercial advantages of the harbors of Table bay, Port Elizabeth, East London, and Alcoa bay,

with a photograph of a mail steamer plying between the colony and the mother country.

In Russia's section, on the ground floor, is a large exhibit from her naval department, including a model of the cruiser *Rurik*, with the hoisting apparatus for lowering and raising torpedo boats. Side by side with the miniatures which stand for the might of Russia's naval power is a reproduction of the *Yahl*, the boat in which



CANOE, FROM AFRICA



A TURKISH CARRIER

Peter the Great first learned to love the sea and formed the plans that resulted in the founding of the navy, of which the original of this tiny craft, less than eleven feet in length, has been called the grandfather. Elsewhere are coils of rope such as are used by men of war; and beyond is a small model of a train of military hospital cars, the history and present condition of the naval department being also represented in government literature.

Across the hall is an exposition of the work which has and is being done by the naval department of Japan. One of the walls is covered with charts, maps, and inscriptions explanatory of the work of the hydro-



FULL SIZE MODEL OF BATTLE SHIP "ILLINOIS," IN WORLD'S FAIR HARBOR

graphic office, established in 1870. There are drawings showing the configuration of the coasts, their safe channels and their dangerous reefs, and here the statement is made that this is the first attempt by any Asiatic country to furnish its navigators with nautical charts, the progress achieved in this direction being without the aid of foreign engineers. In this section is a modern rapid-firing gun with automatic recoil carriage, and there are models of steamships, one of them showing a transverse section, and of a boiler intended for a Japanese cruiser fashioned by the students of the dockyard school at Yokosuka.

Among the curiosities in the northern gallery are the log canoe and dugout sent by the United States consul at St Paul de Loando, the capital of a Portuguese colony on the western coast of Africa. The canoe,



THE GOLDEN DOOR AND ITS REFLECTION

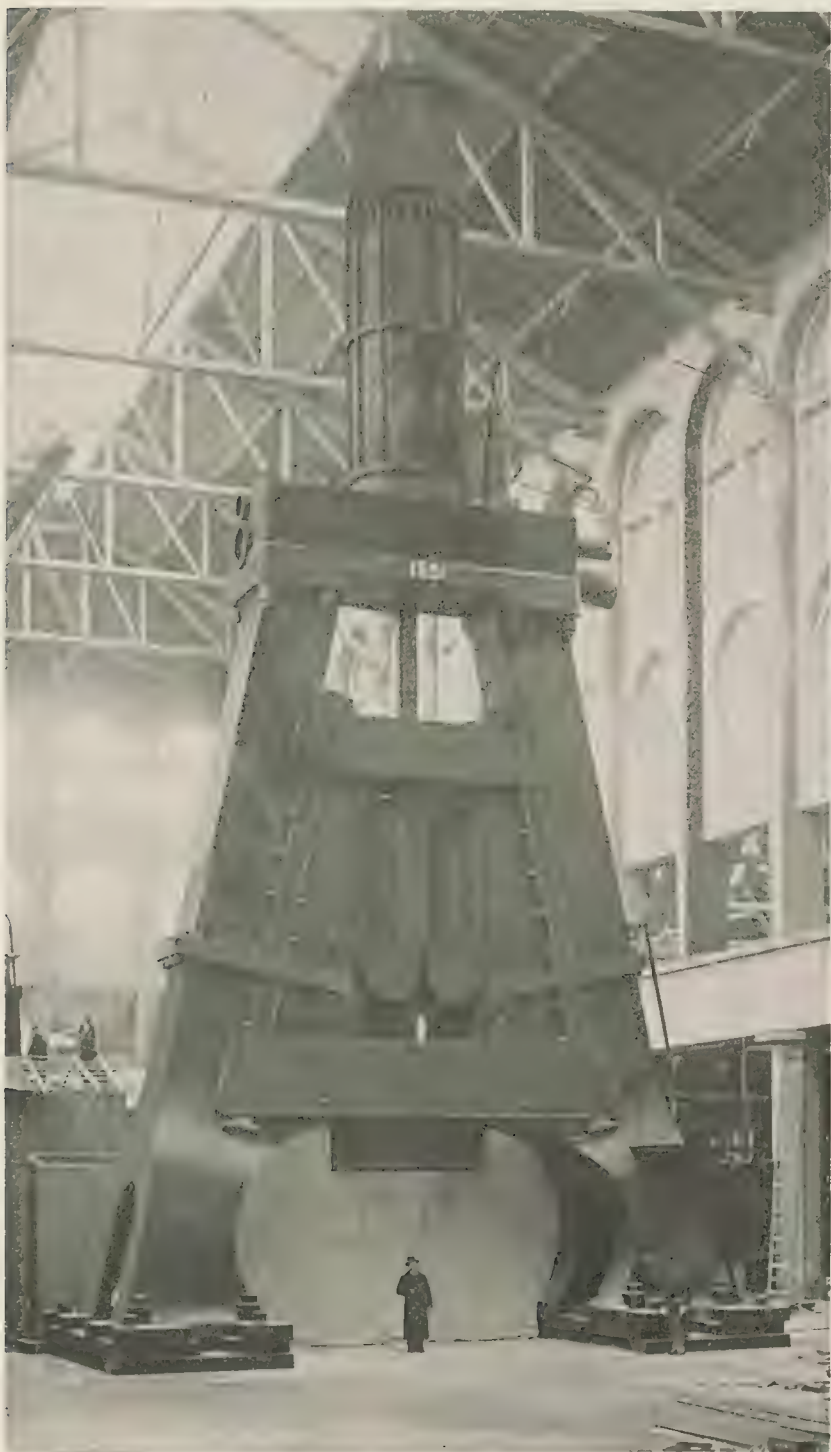
or so-called bimba, resembles the catamaran, its frame resting on a raft as in Chinese river craft. These clumsy devices are also reproduced in photographs, the dugout containing a dusky occupant whose naked body glistens as brightly as the waters that surround him.

Near the Austrian section on the ground floor of the hall, Spain illustrates the historic development of her naval architecture. Almost side by side with models of the Columbian caravels are the iron-clads of her modern navy, and in prints on the outside of the booth may be traced the evolution of her merchant marine and war ships up to the present day. From the arsenal at Cartagena and the manufactories of Barcelona are cables, cordage, and other nautical appliances.

In the northeastern portion of the annex, and in the northern part of the main building, small sections are occupied by Spain, showing the character of her coast defenses and other engineering works, with the progress made in the construction of her weapons. From the museum of royal engineers comes a large collection of models of such fortifications as those of San Sebastian and Cartagena. The plan of the Havana water-works and bridges, ancient and modern, including the one at Cordova, are also reproduced. The manner of transporting bridges on the backs of donkeys, during a military campaign, is elsewhere illustrated, and in this section is a case filled with the swords, halberds, and other mediæval arms of Toledo make. In the annex are models of fire-arms, and a long array of cannons a contribution from the king, some of them dating almost from the time of Cortés.

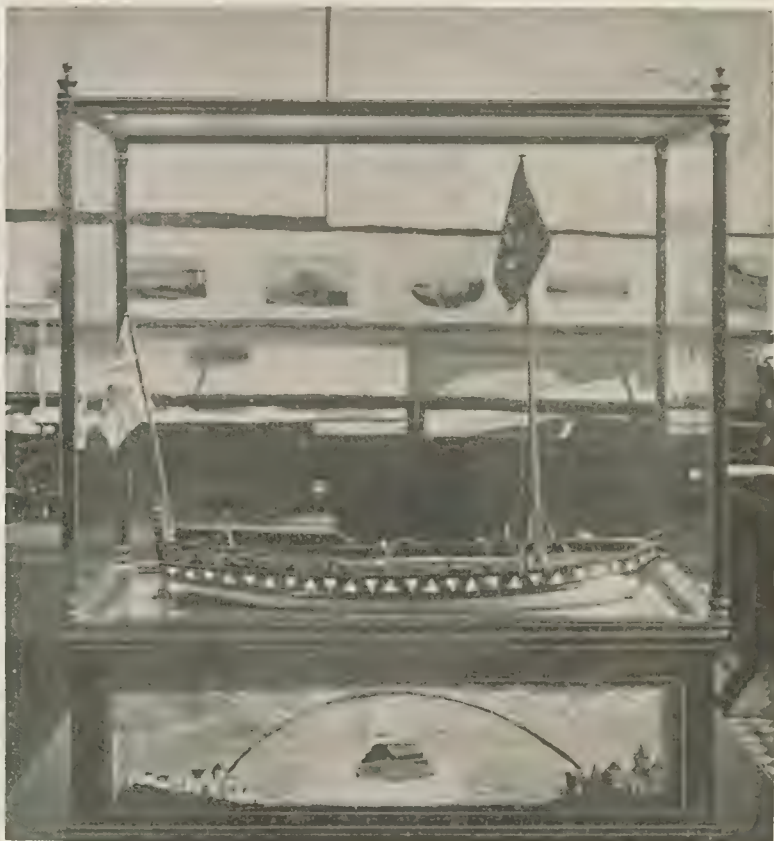
In the United States section devoted to naval warfare and coast defense, a few manufacturers illustrate

some of the most recent appliances, a Massachusetts inventor, for instance, showing a pneumatic dynamite gun, with torpedoes as projectiles. But in this group the main exhibit is from the Bethlehem Iron company, of Pennsylvania. Toward the south of the hall, rising almost to the roof and astride its central aisle, is a gigantic frame, apparently of solid iron, supporting



THE BETHLEHEM STEAM HAMMER

by the fact that it would almost have blocked the central passage-way of the building. Here, then, is the shadow of the huge implement which welded the armor plates, steamer shafts, and other massive articles grouped in this section of the hall. A plate of steel armor, more than ten inches thick, is shown as battered by a shell travelling 700 feet a second, and near it is the first plate made by the company in 1891, two 100-pound shells having pierced its eleven inches of solid metal. A nickel steel plate for the battle-ship *Indiana*, protecting one of her thirteen armored sections, is 17 inches thick, 12 feet high, and weighs nearly 70,000 pounds. Near by is the model of a casting for heavy armor plates, 18 feet high, nearly half as wide, and 52 inches thick, with a weight of 25,000 pounds. By way of suggesting how such armor can be penetrated, the company shows a piece of naval ordnance, 36 feet long, weighing more than 50 tons, and with a twelve-inch breech. The manufacture of shafting requires even more skill than that of gun forgings,



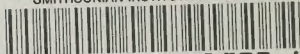
IN THE GALLERY

a huge hammer of cylindrical shape. This imposing structure, 90 feet in height, with a span of nearly 40 feet, is a reproduction of the apparatus which carries the steam forging hammer of the Bethlehem works. The original mechanism weighs more than 2,000 tons, and the ram and rod 125 tons, forming the largest hammer in the world. The replica is of wood and staff, and the absence of an anvil is explained



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